US009164423B2

(12) **United States Patent**
Mochizuki et al.

(10) **Patent No.: US 9,164,423 B2**
(45) **Date of Patent: Oct. 20, 2015**

(54) **DEVELOPER REPLENISHMENT CONTAINER ACCOMMODATING APPARATUS, DEVELOPER REPLENISHMENT CONTAINER, AND IMAGE FORMING APPARATUS**

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(72) Inventors: **Kazuhiro Mochizuki**, Misato (JP); **Akira Masuda**, Tachikawa (JP); **Yutaka Ban**, Tokyo (JP); **Nobuo Nakajima**, Higashi Matsuyama (JP)

(73) Assignees: **CANON FINETECH INC.**, Misato-shi (JP); **CANON KABUSHIKI KAISHA**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 36 days.

(21) Appl. No.: **13/681,920**

(22) Filed: **Nov. 20, 2012**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Dec. 16, 2011 (JP) 2011-276318

(51) **Int. Cl.**
G03G 15/08 (2006.01)

(52) **U.S. Cl.**
CPC ***G03G 15/0867*** (2013.01); ***G03G 15/0872*** (2013.01); ***G03G 15/0886*** (2013.01)

(58) **Field of Classification Search**
CPC G03G 2215/0665; G03G 2215/0668; G03G 15/0837; G03G 2221/1654
See application file for complete search history.

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Primary Examiner — Billy Lactaoen
Assistant Examiner — Arlene Heredia Ocasio
(74) *Attorney, Agent, or Firm* — Fitzpatrick, Cella, Harper & Scinto

(57) **ABSTRACT**

A developer replenishment container accommodating assembly, in which a developer replenishment container is removably put in a main body of an accommodating apparatus, replenishes a developer while rotating the developer replenishment container and includes a holding portion provided on the main body and configured to hold the developer replenishment container put in the main body of the accommodating apparatus in a replenishment position for replenishing the developer, and an engaging portion configured to engage with the developer replenishment container when it is positioned in the main assembly. In addition, a biasing member is configured to bias the engaging portion in a predetermined direction so that the developer replenishment container rotating while held by the holding portion is pressed against the holding portion by the biased engaging portion.

15 Claims, 25 Drawing Sheets

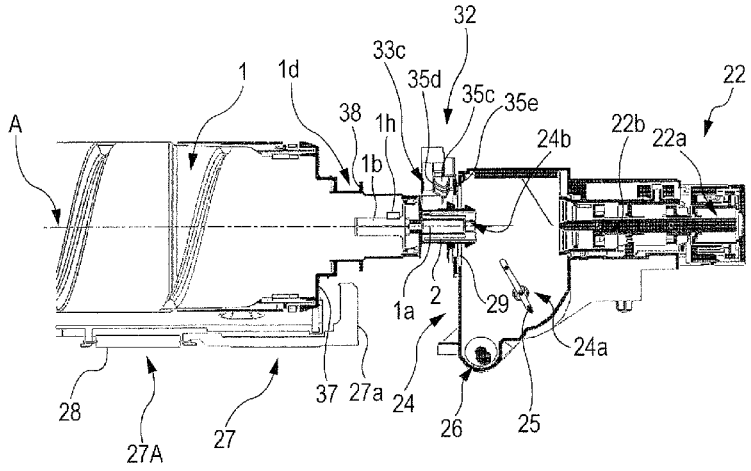

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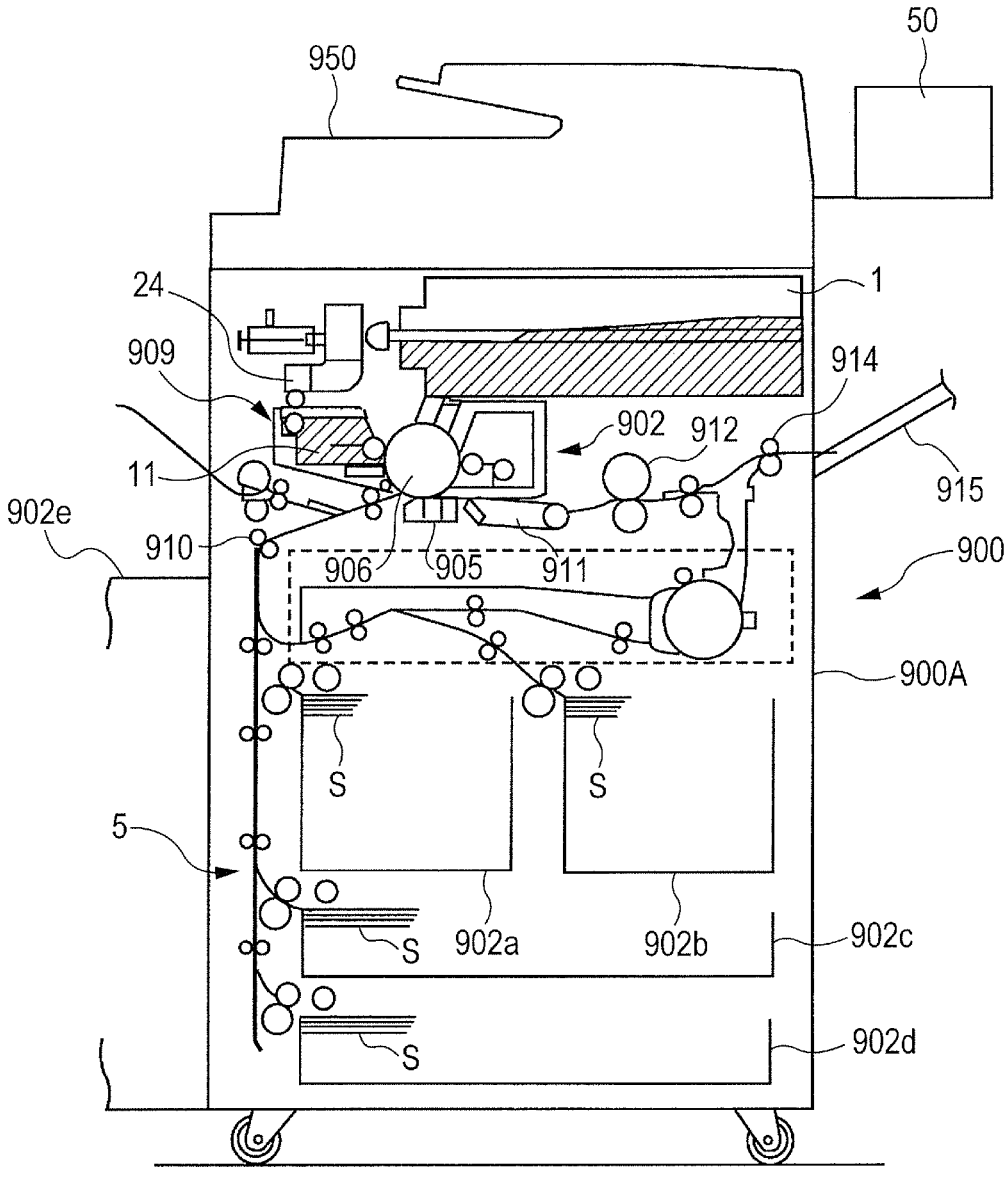
FIG. 1


50
950
24
1
909
914
902
912
11
915
902e
910
906
905
911
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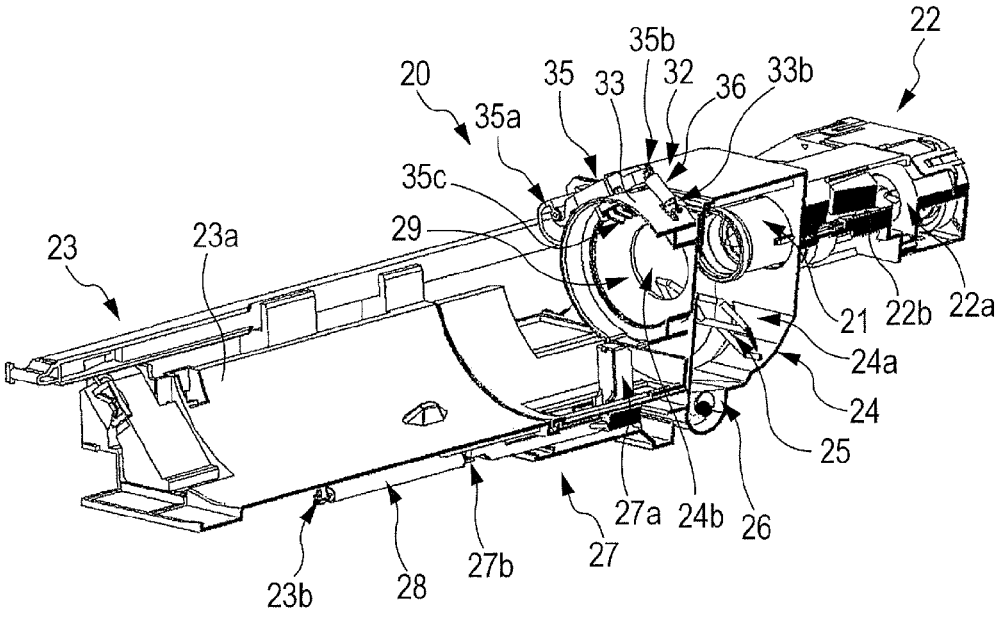
900A
S
S
5
S
902a
902b
902c
S
902d

FIG. 2


22
35b
20
35
33
32
36
33b
35a
35c
29
23
23a
21
22b
22a
24a
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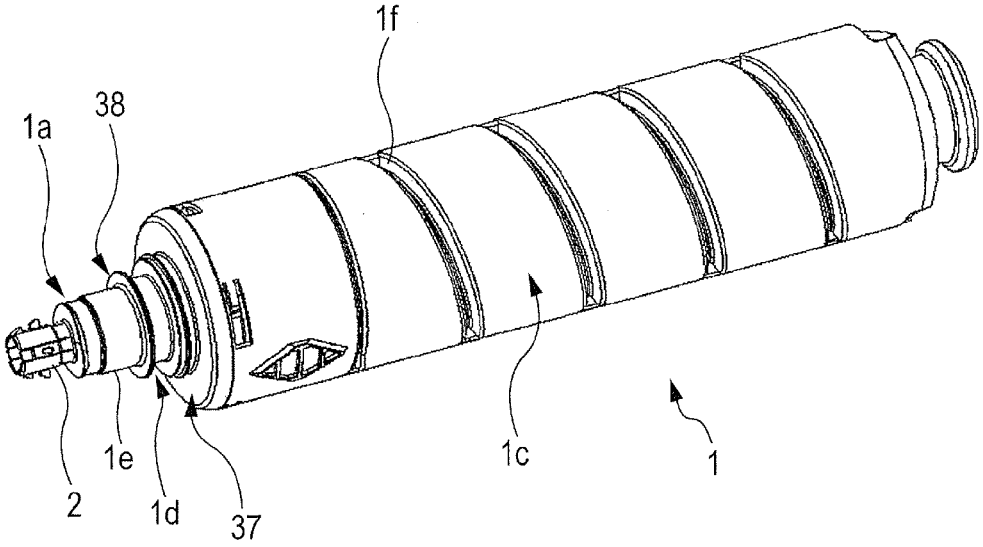
27a
24b
26
27
27b
28
23b

FIG. 3


1f
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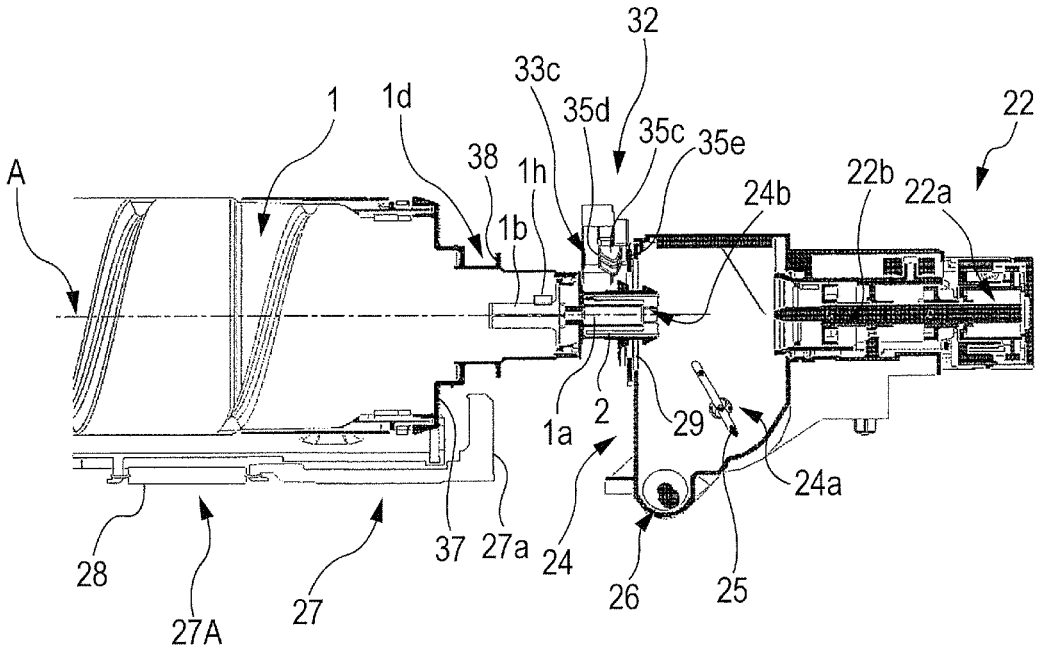
1e
2
1d
37
1c
1

FIG. 4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33c
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1d
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35c
35e
22
38
1h
22b
22a
A
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1a
2
29
24a
28
37
27a
24
26
25
27A
27

FIG. 5A

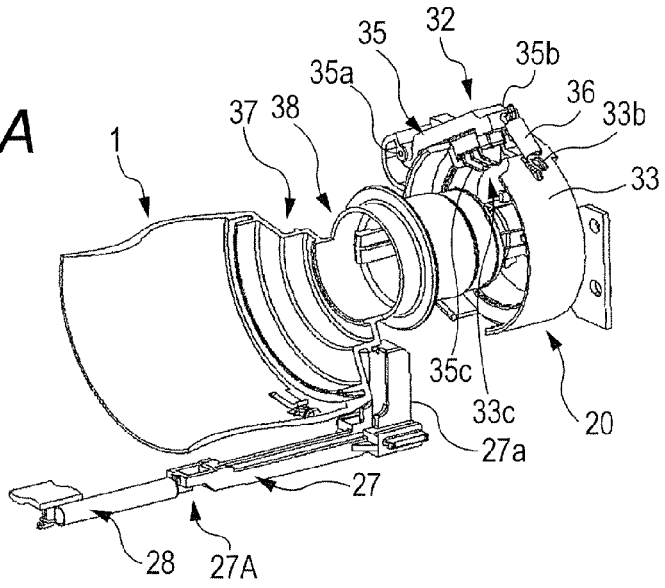


FIG. 5B

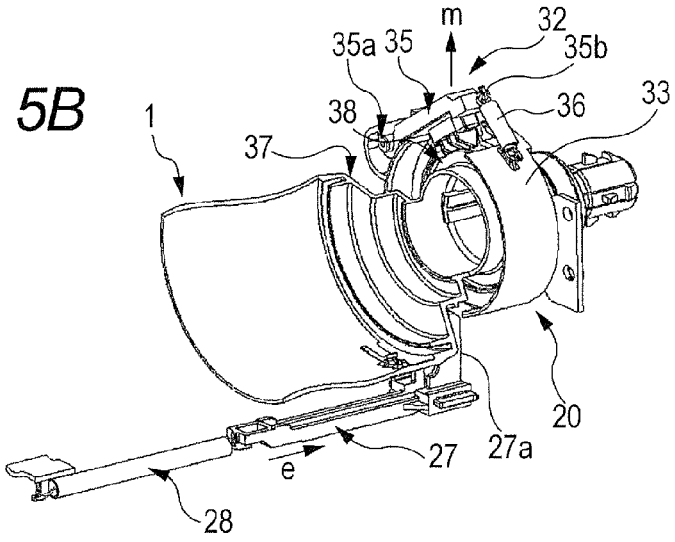


FIG. 5C

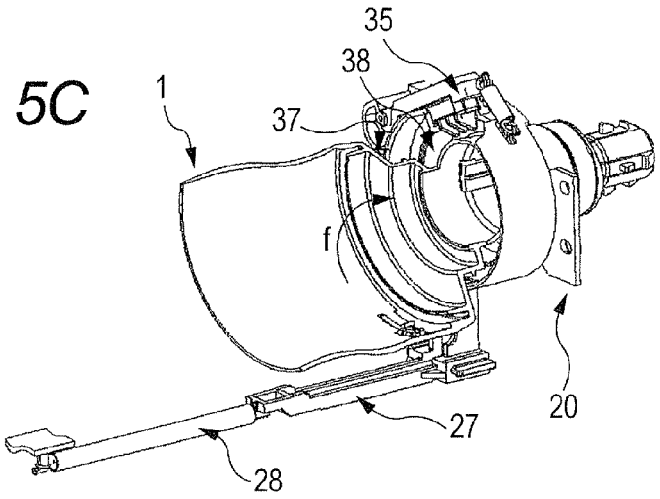


FIG. 6

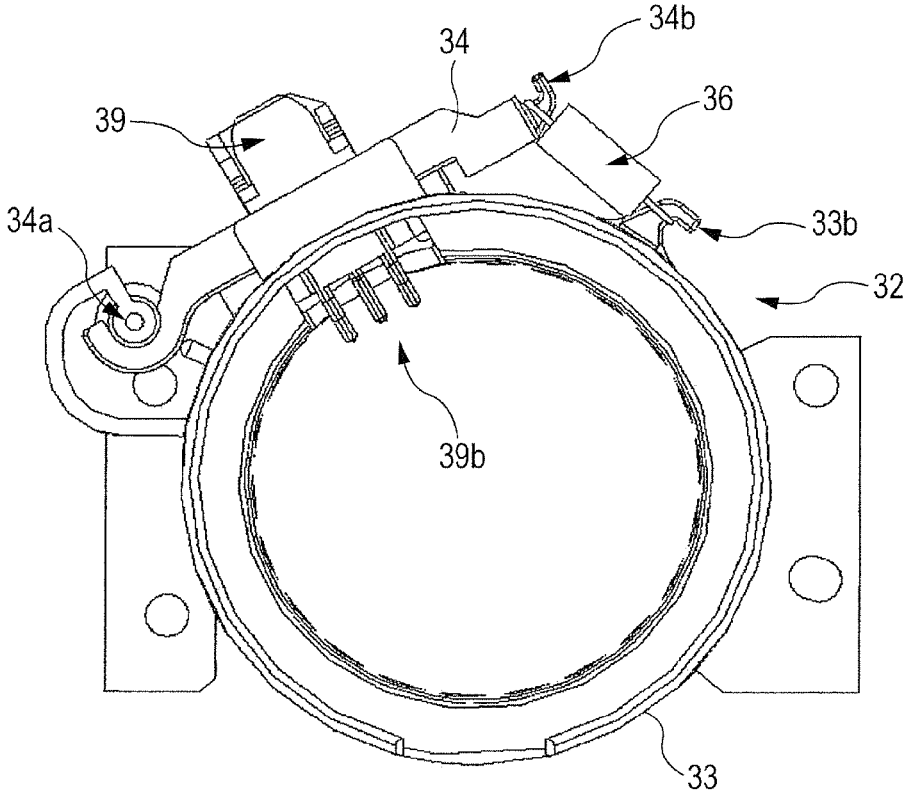


FIG. 7

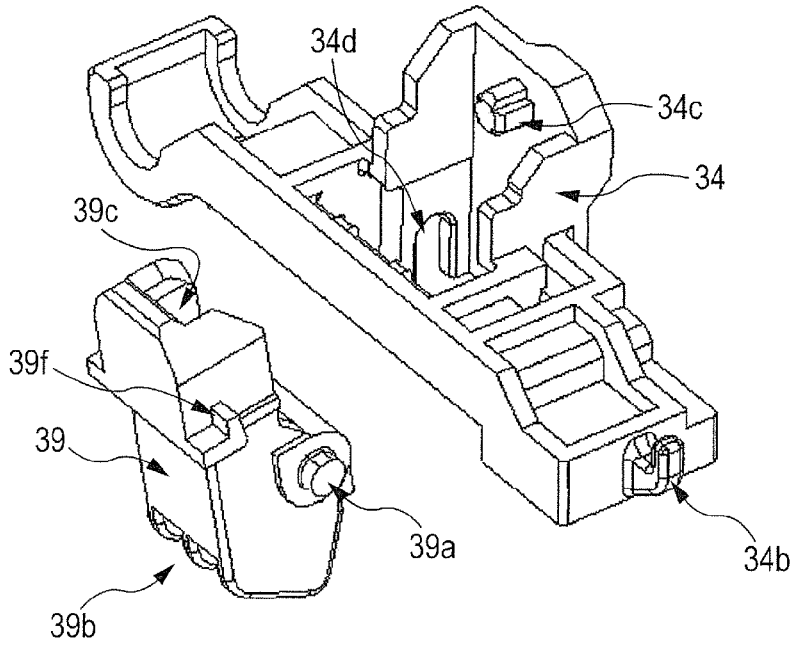


FIG. 8A

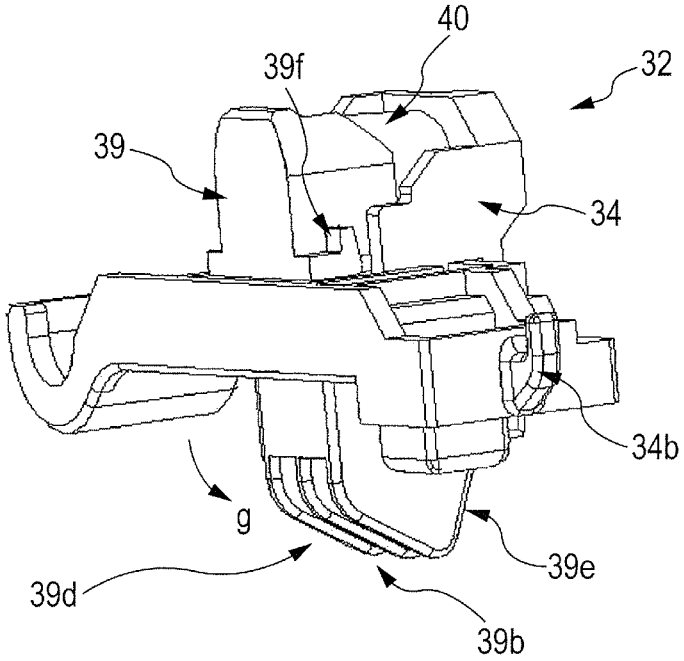


FIG. 8B

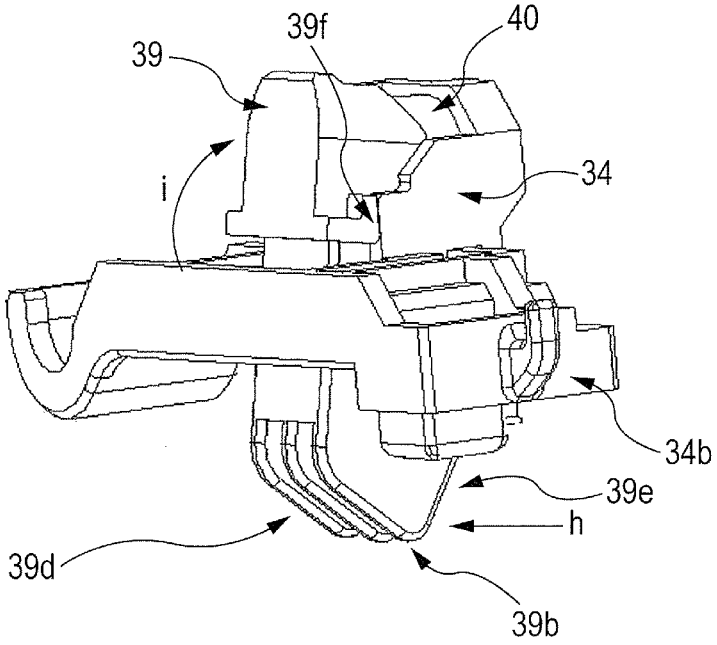


FIG. 9A

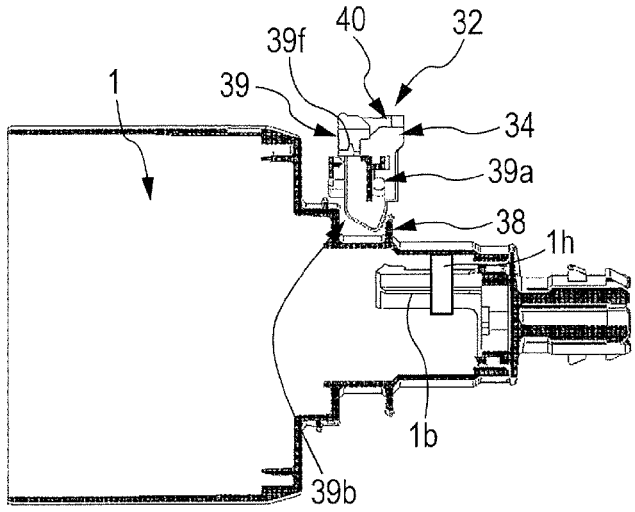


FIG. 9B

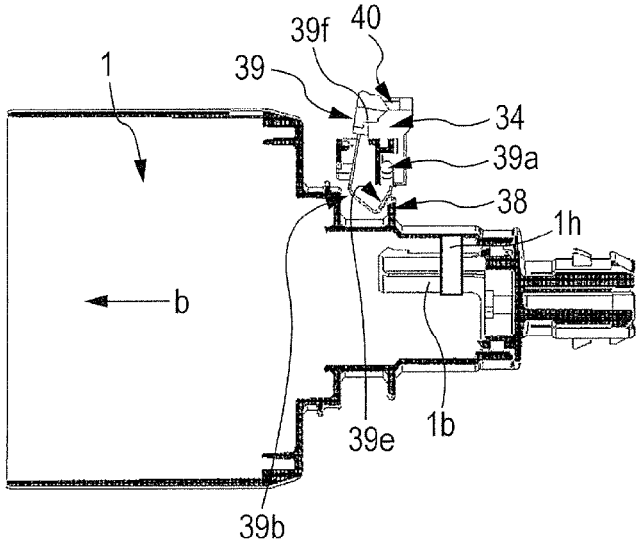


FIG. 9C

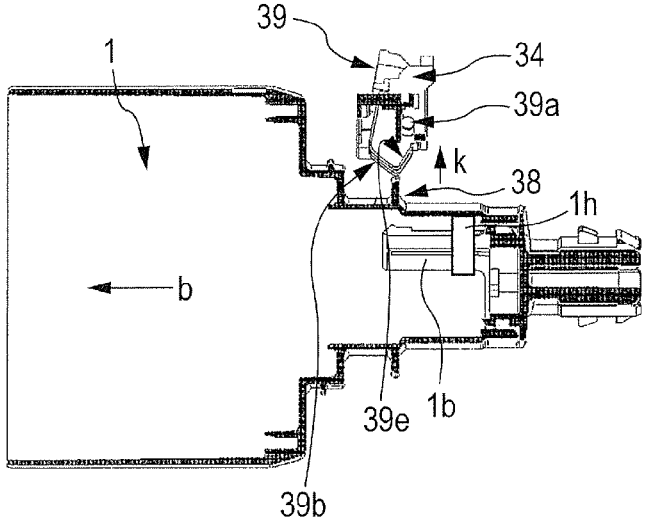


FIG. 10

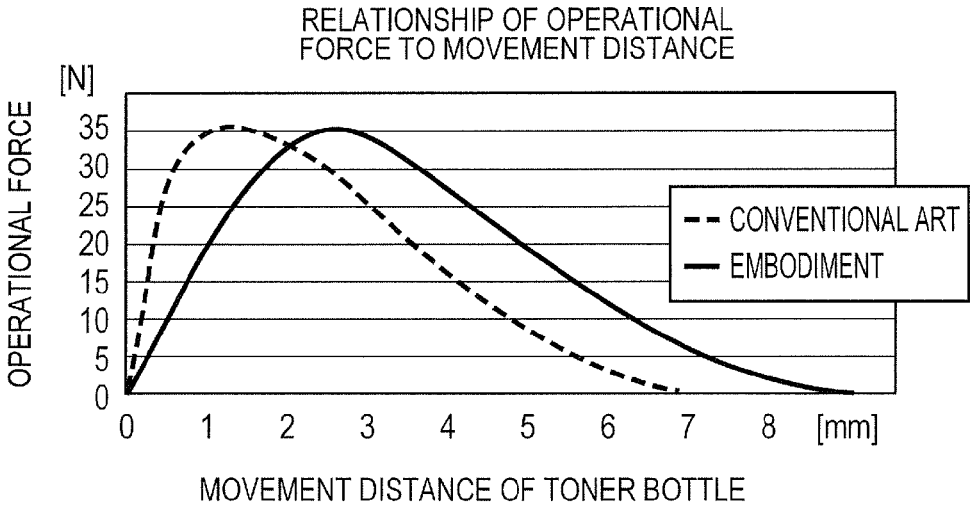

RELATIONSHIP OF OPERATIONAL FORCE TO MOVEMENT DISTANCE
[N]
OPERATIONAL FORCE
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8 [mm]
CONVENTIONAL ART
EMBODIMENT
MOVEMENT DISTANCE OF TONER BOTTLE

FIG. 11

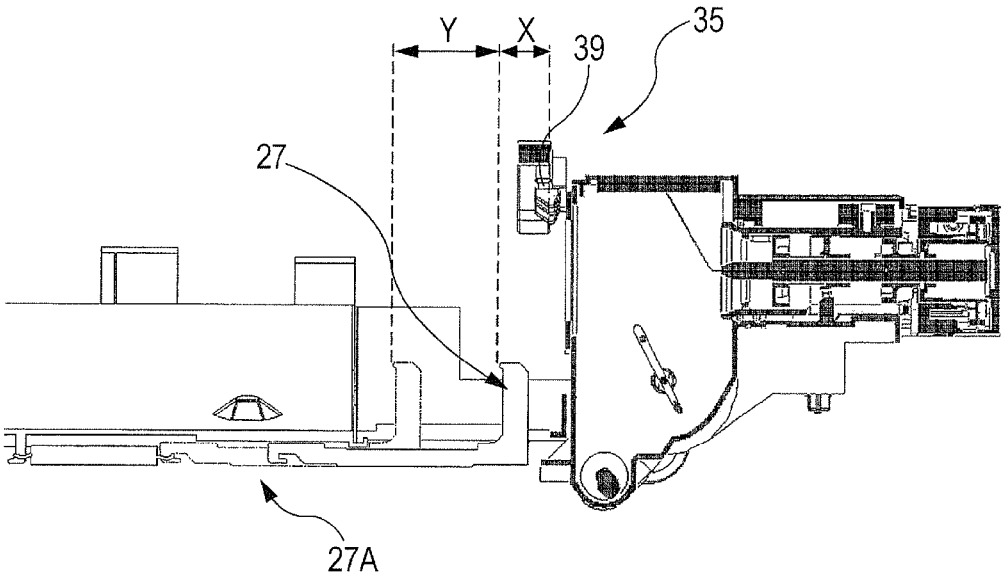

Y
X
39
35
27
27A

FIG. 12

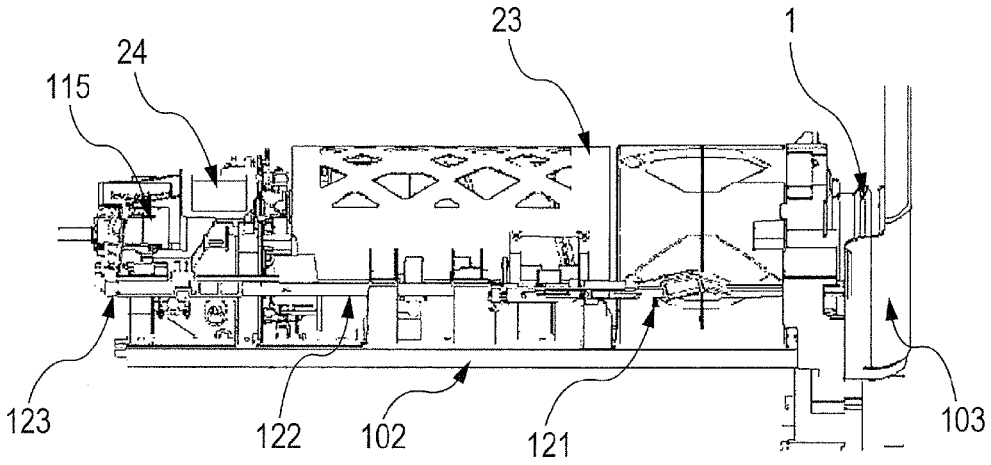


FIG. 13A

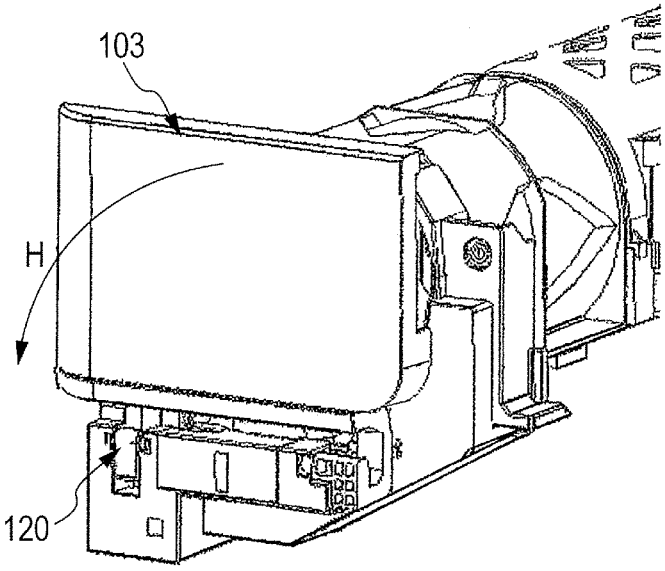


FIG. 13B

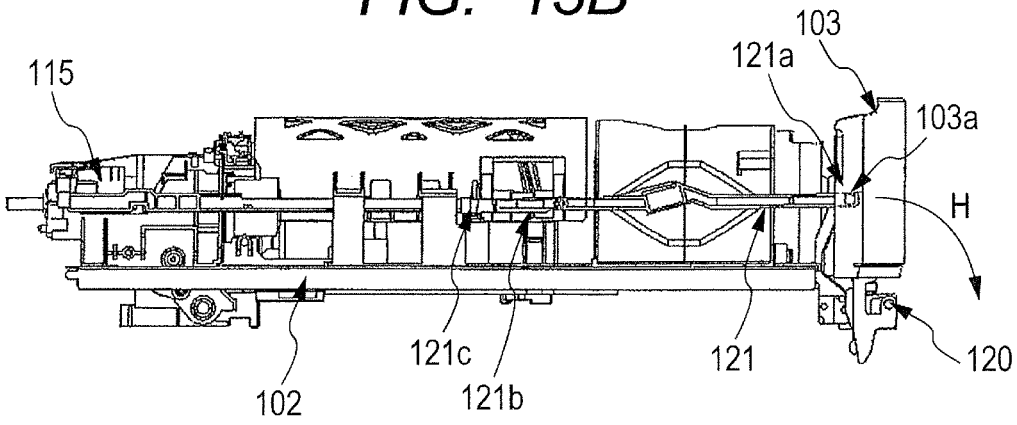


FIG. 14

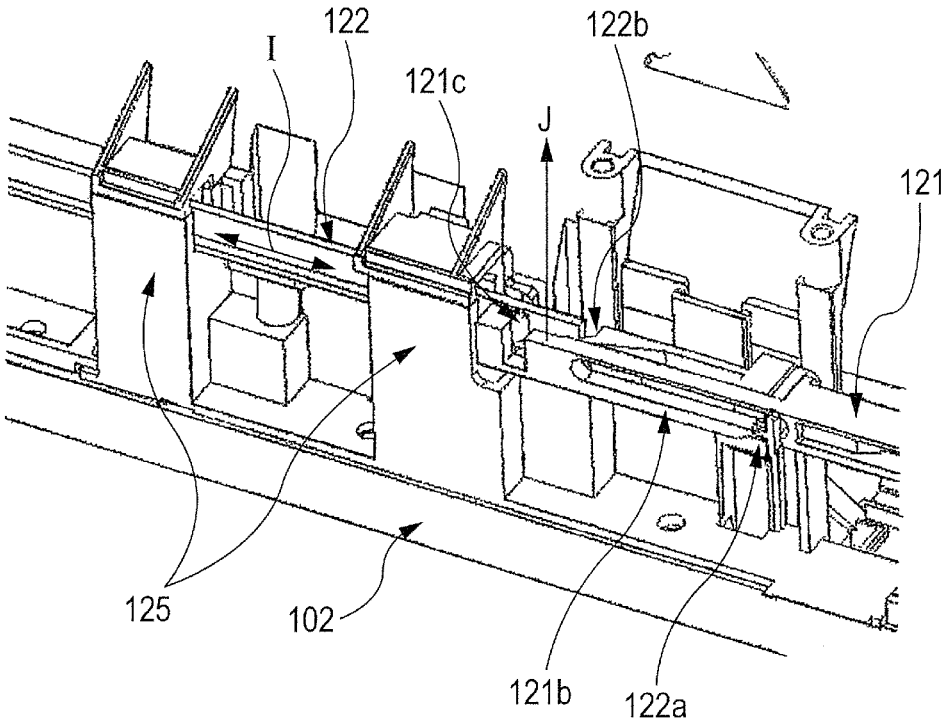


FIG. 15A

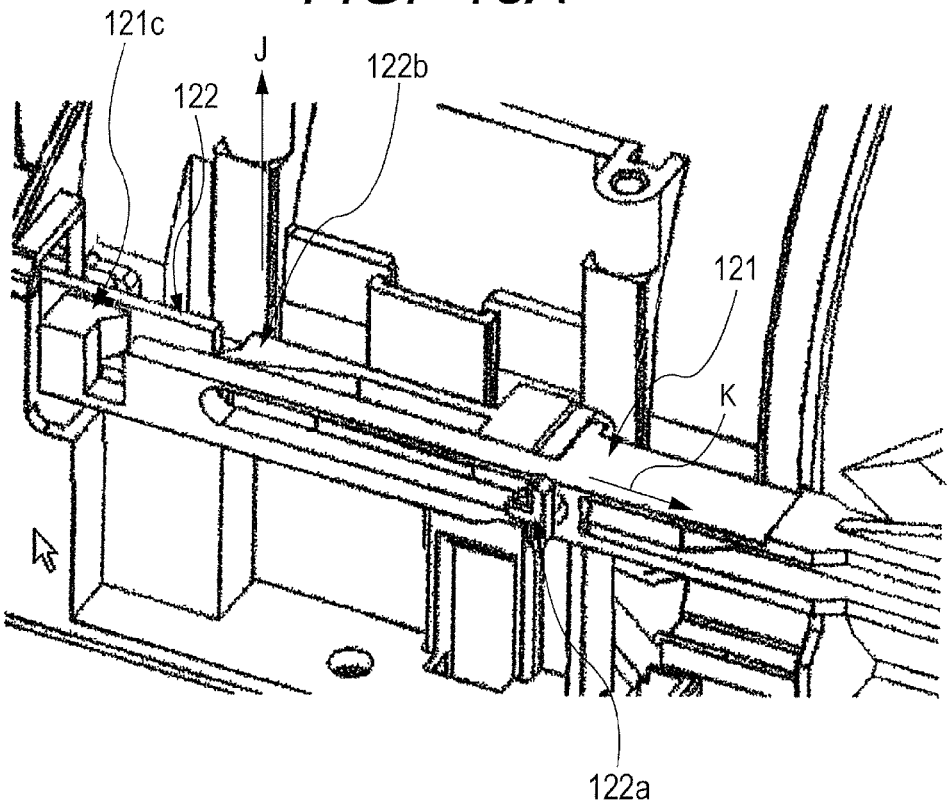


FIG. 15B

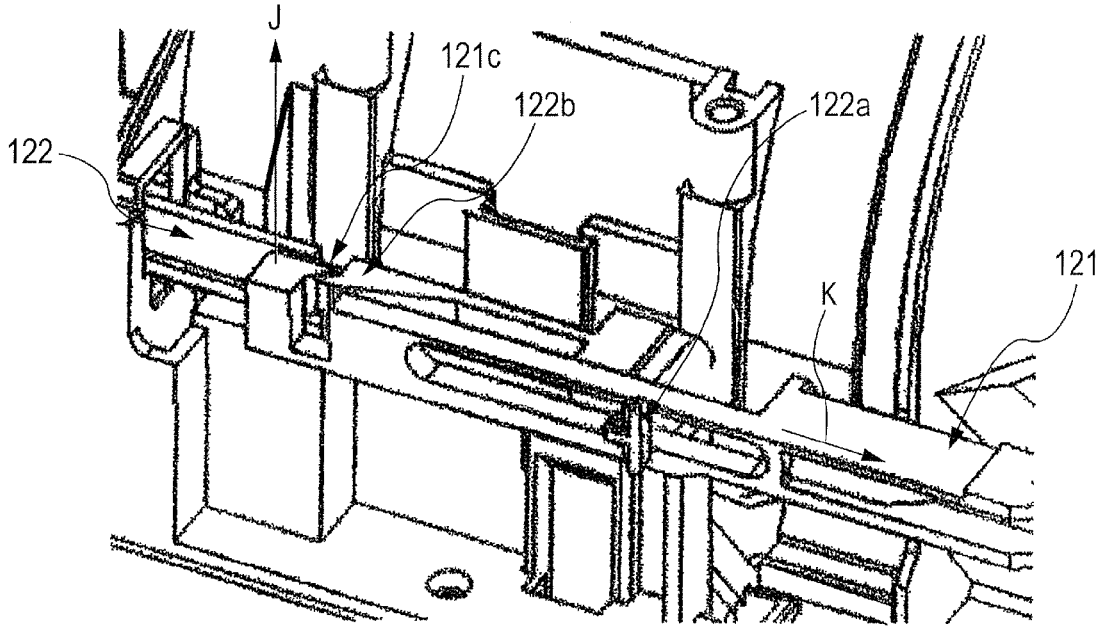


FIG. 16A

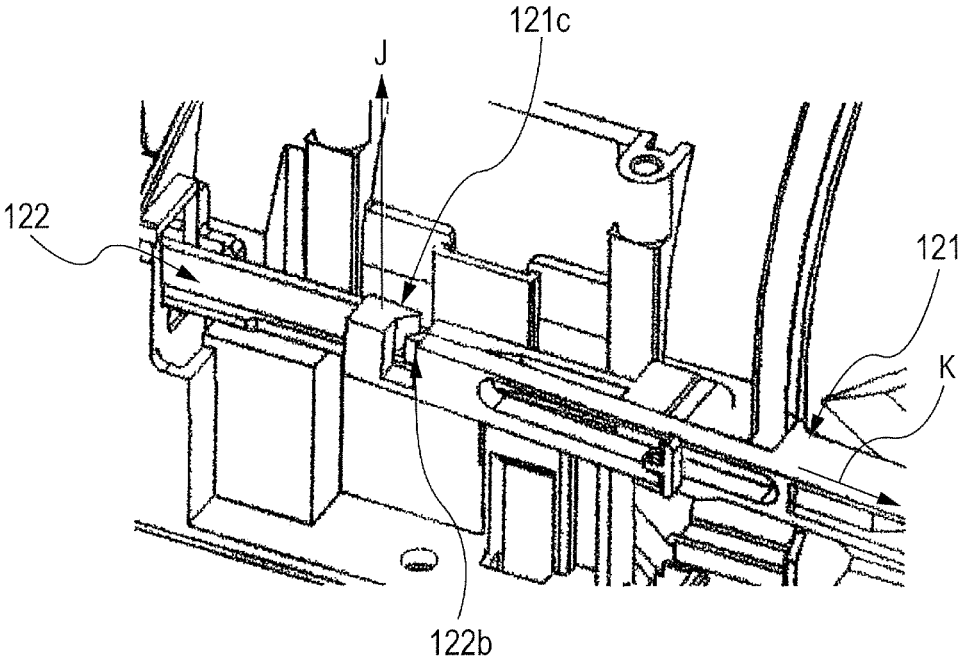


FIG. 16B

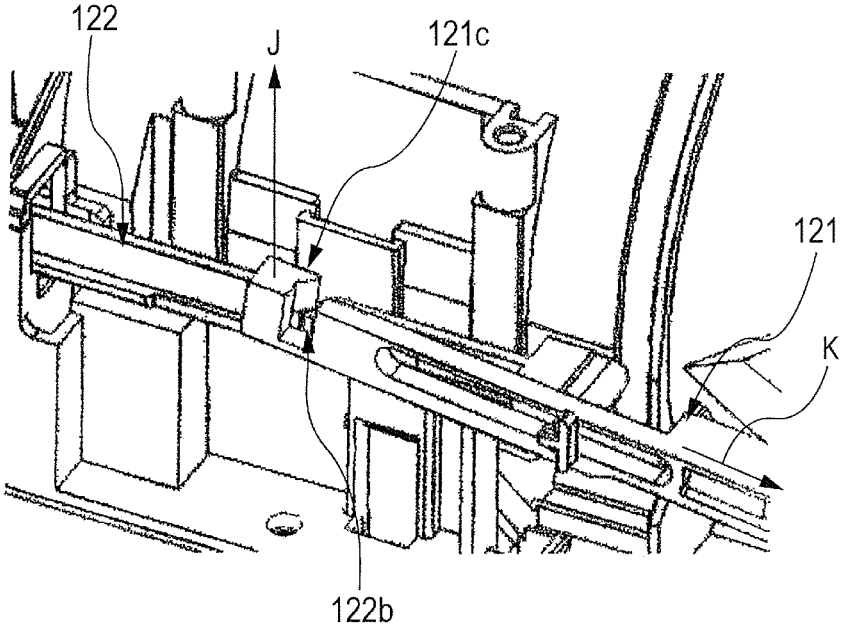


FIG. 17A

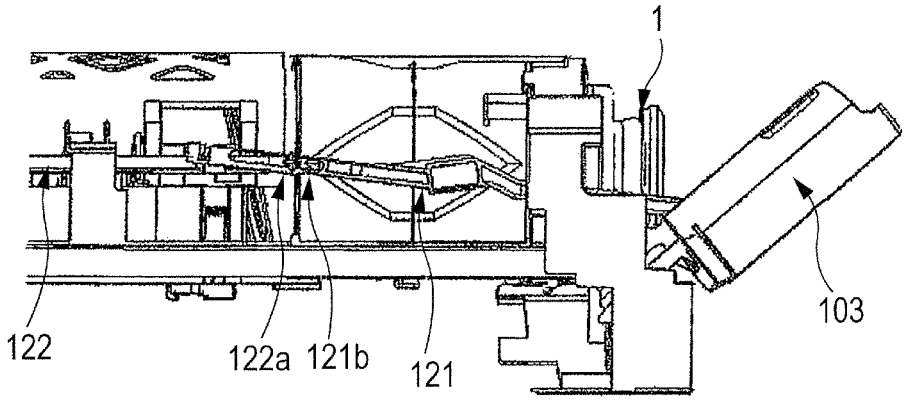


FIG. 17B

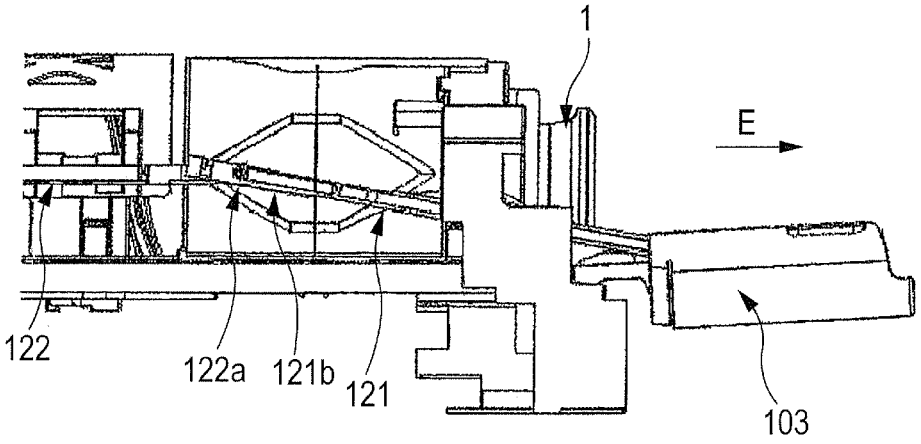


FIG. 18

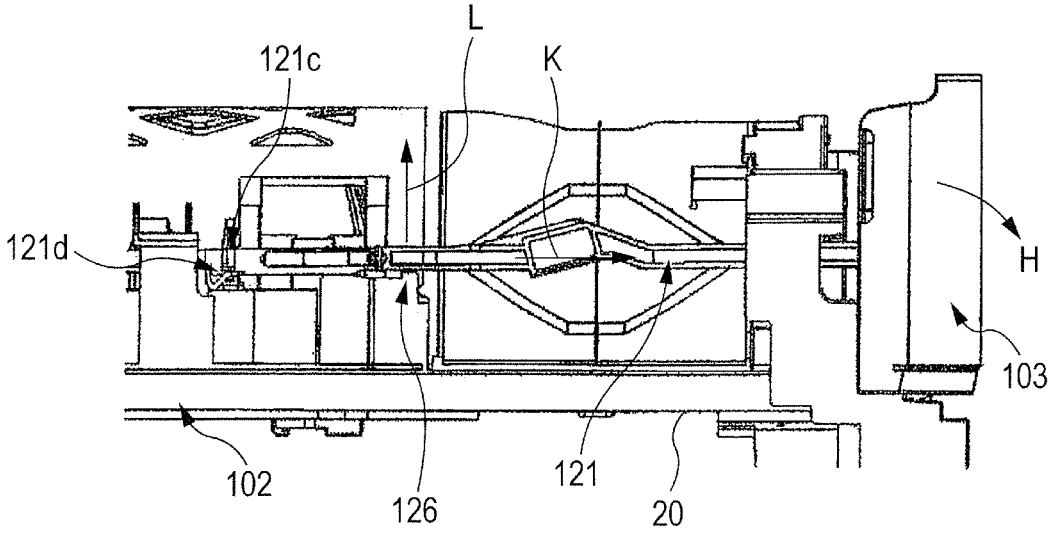

L
121c
K
121d
H
103
102
126
121
20

FIG. 19

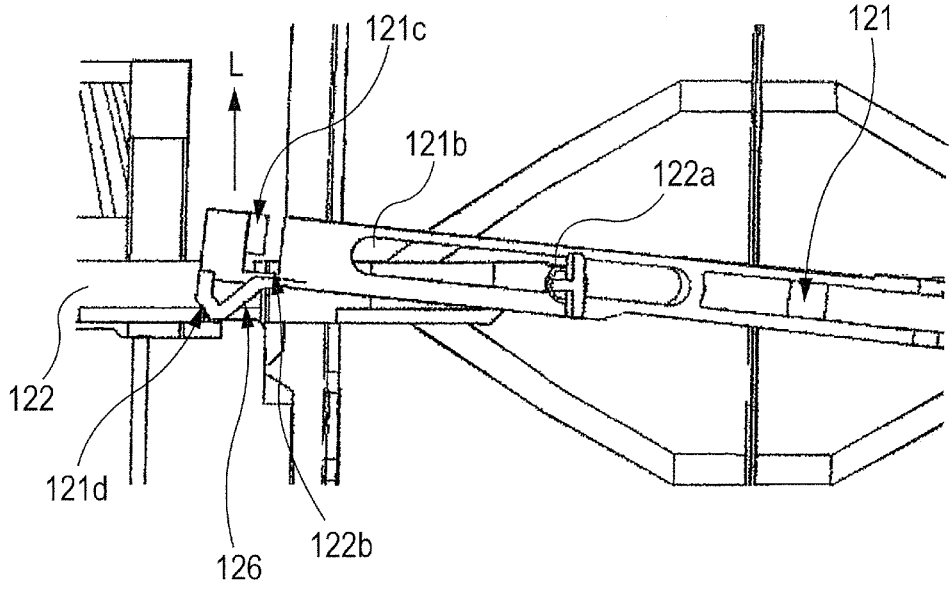

121c
121
L
121b
122a
122
121d
126
122b

FIG. 20

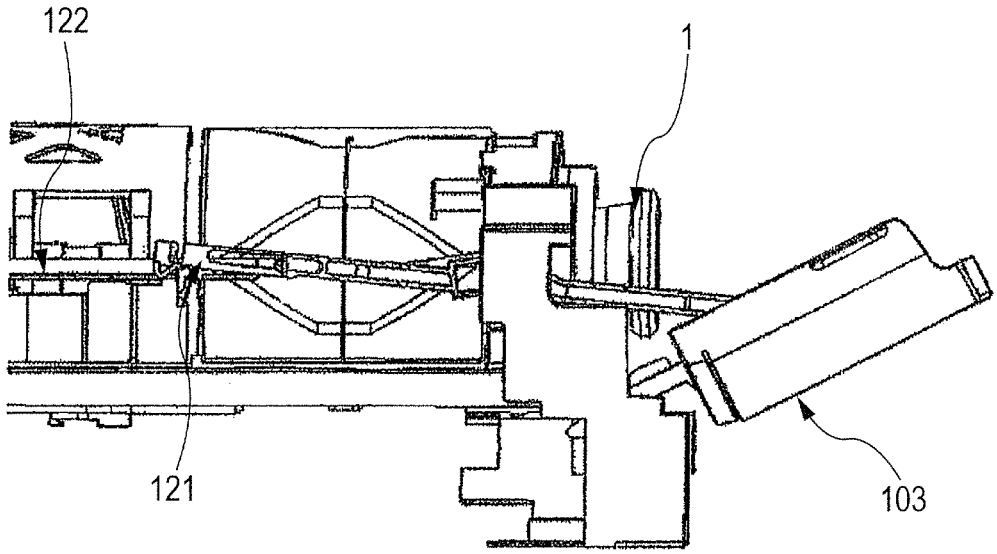


FIG. 21

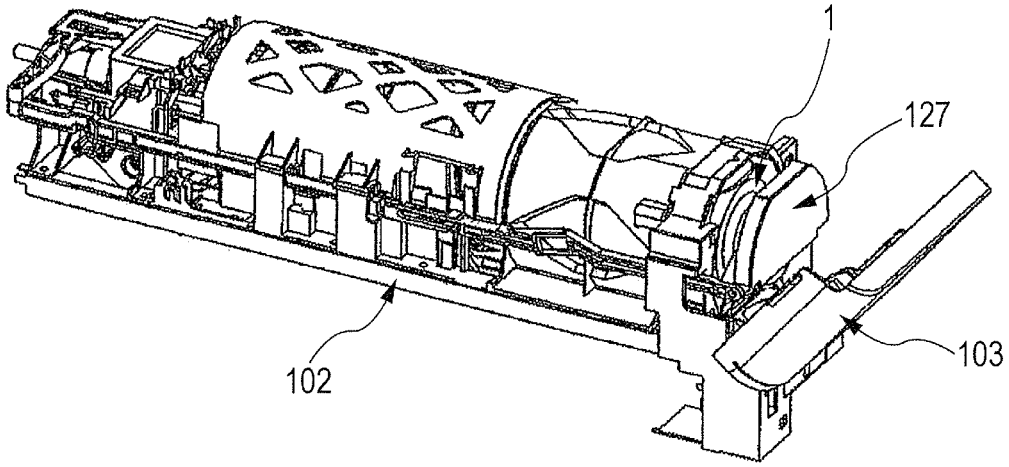


FIG. 22

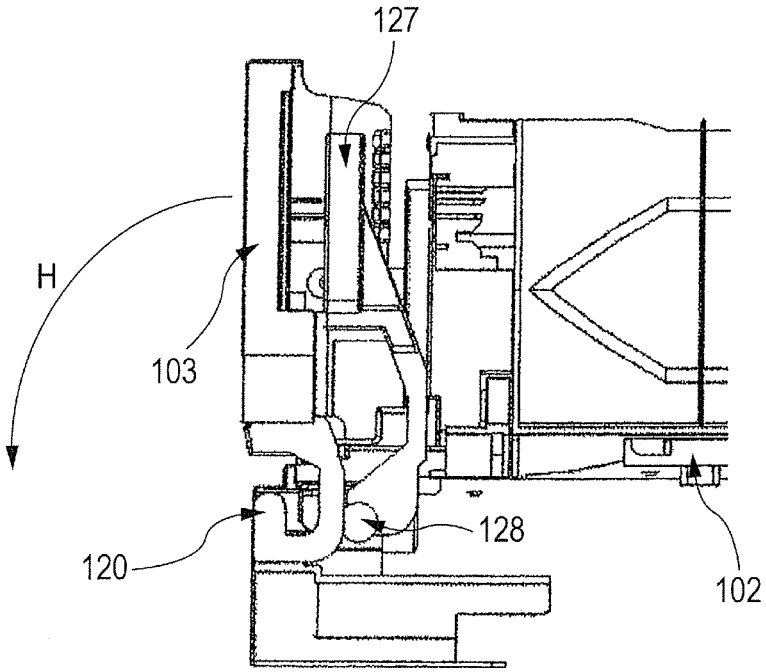


FIG. 23A

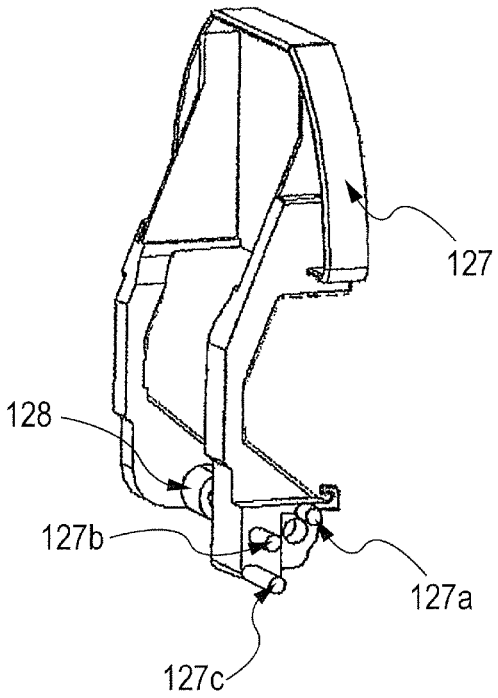


FIG. 23B

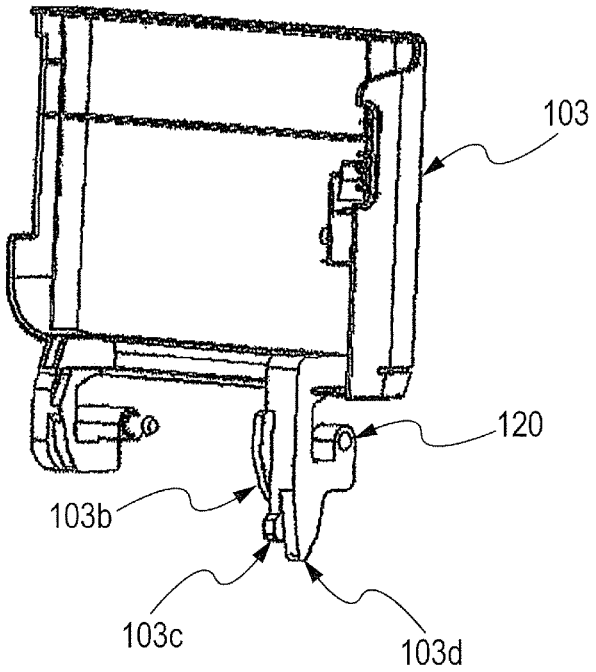


FIG. 24A

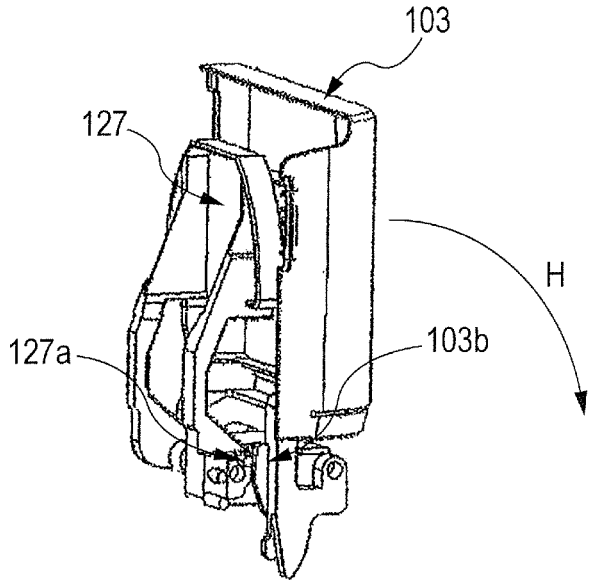


FIG. 24B

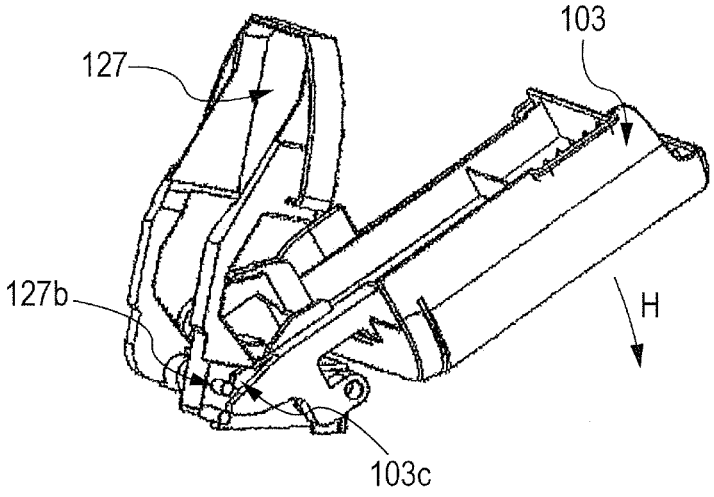


FIG. 24C

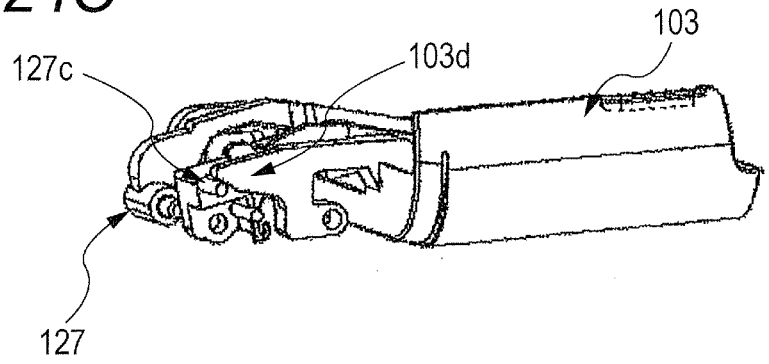


FIG. 25

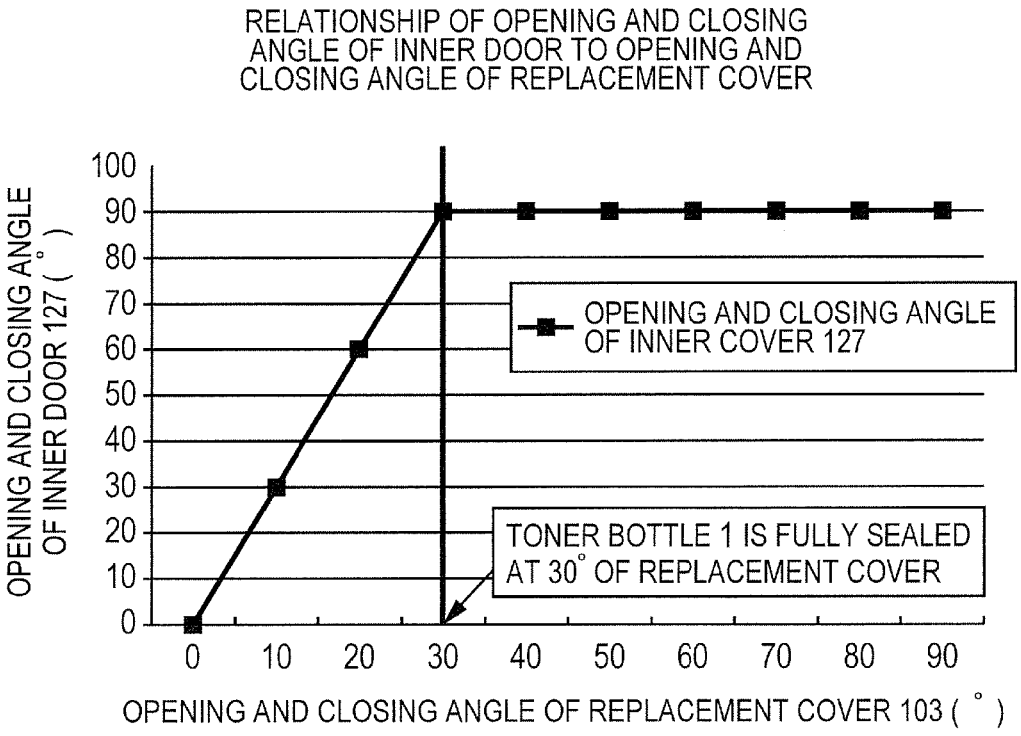

RELATIONSHIP OF OPENING AND CLOSING ANGLE OF INNER DOOR TO OPENING AND CLOSING ANGLE OF REPLACEMENT COVER
OPENING AND CLOSING ANGLE OF INNER DOOR 127 (°)
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
OPENING AND CLOSING ANGLE OF INNER COVER 127
TONER BOTTLE 1 IS FULLY SEALED AT 30° OF REPLACEMENT COVER
OPENING AND CLOSING ANGLE OF REPLACEMENT COVER 103 (°)

FIG. 26A

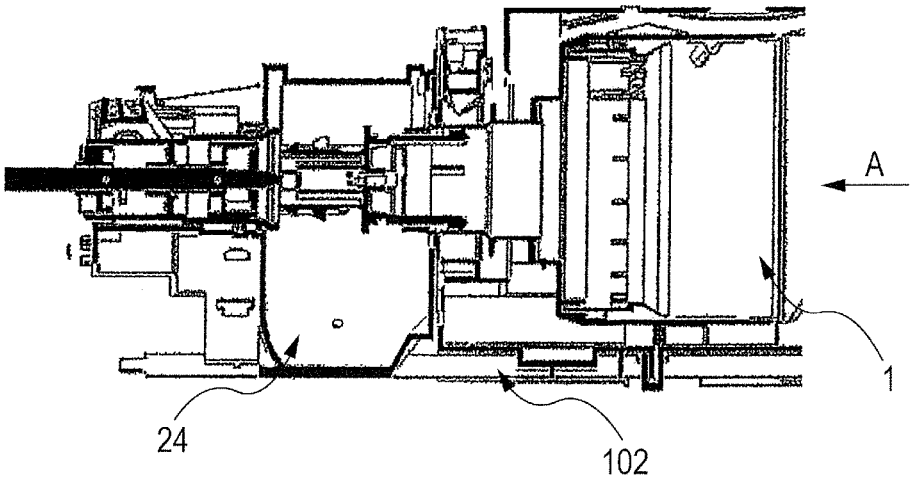


FIG. 26B

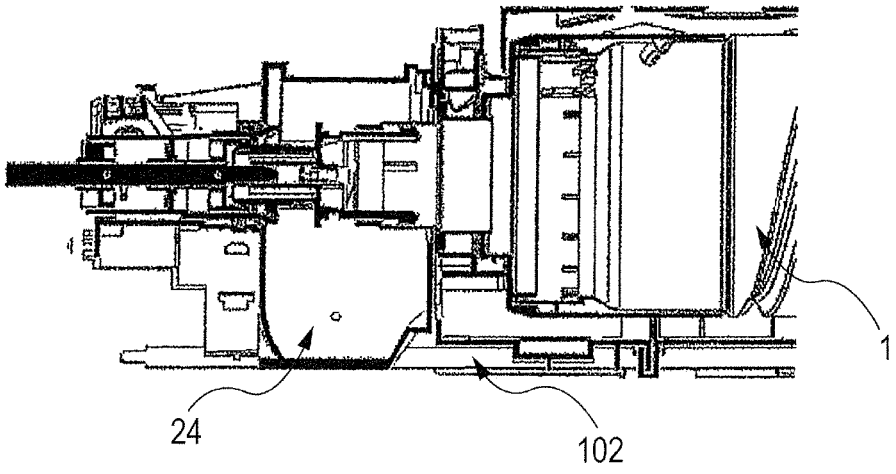


FIG. 27

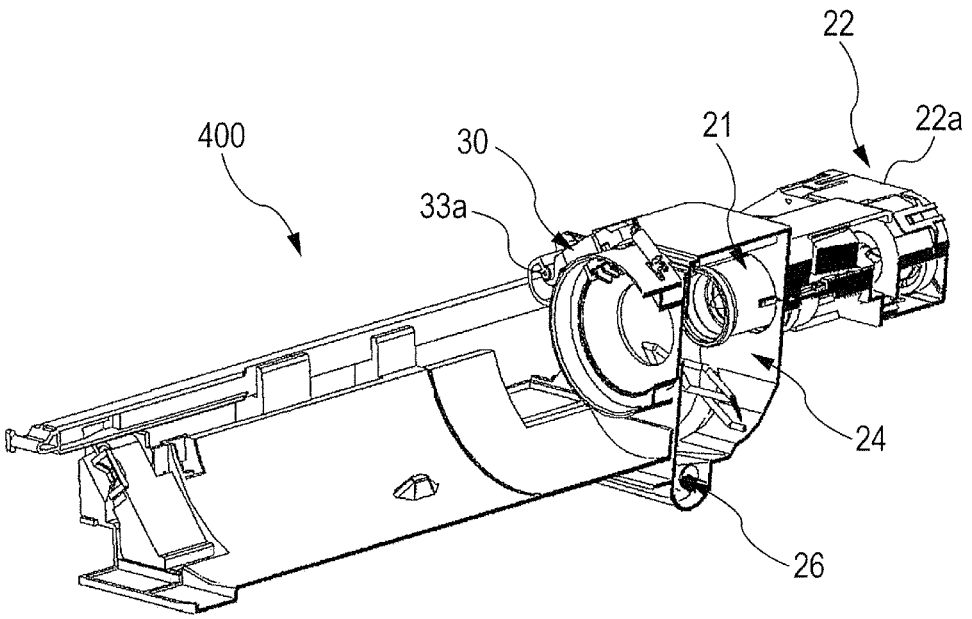


FIG. 28A

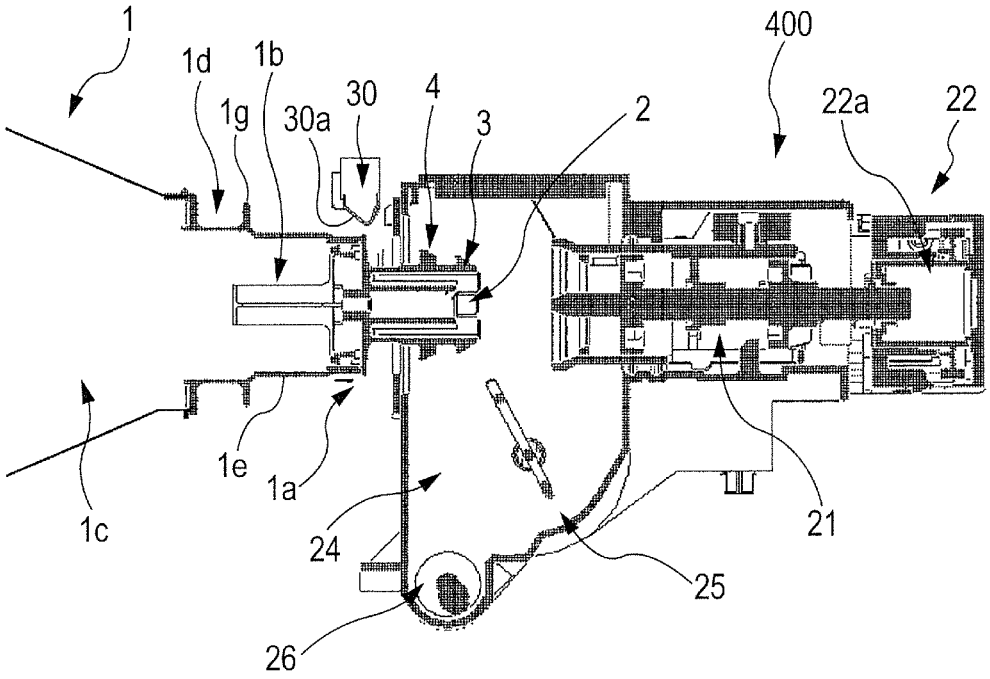


FIG. 28B

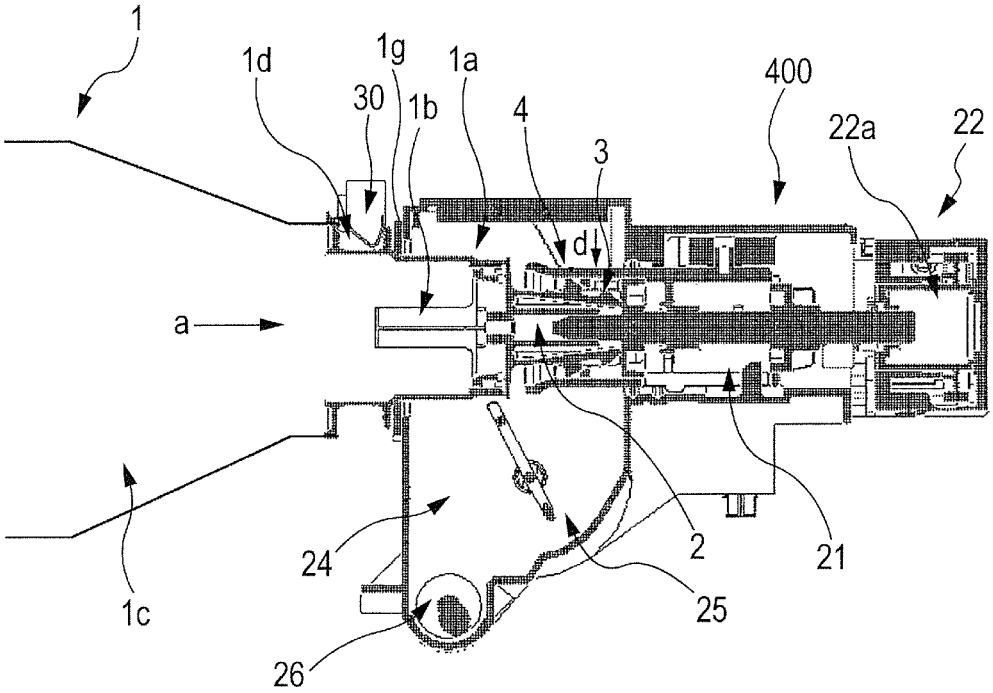


FIG. 29A

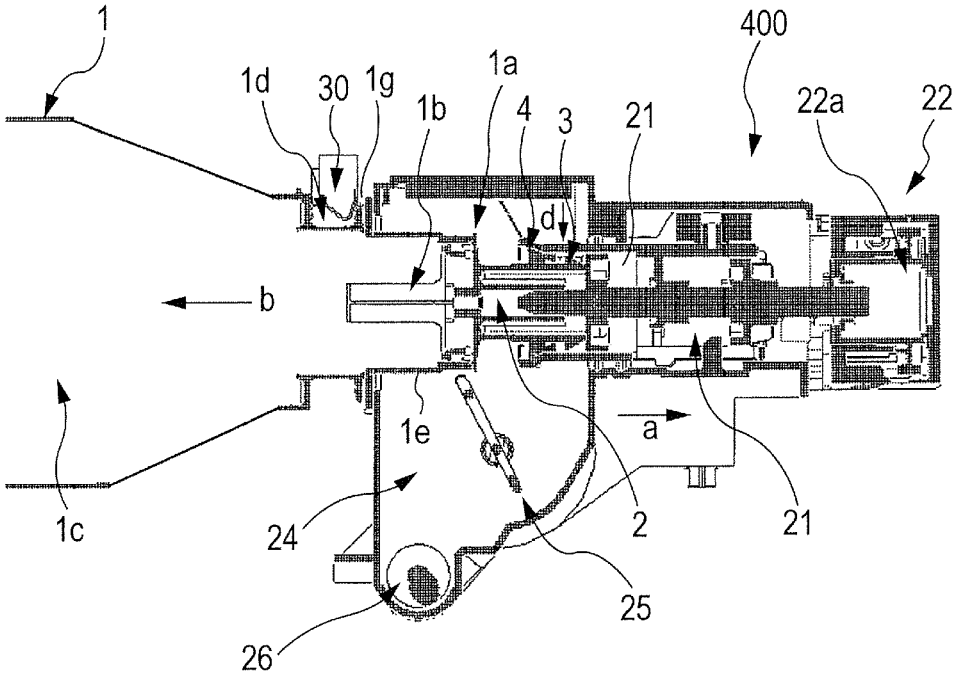


FIG. 29B

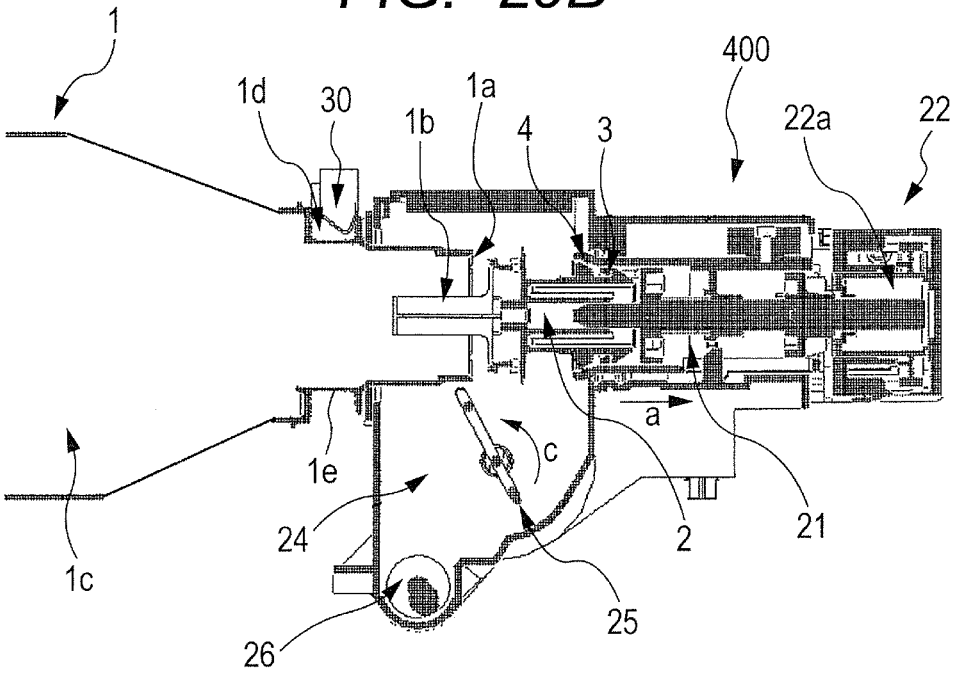


FIG. 30A

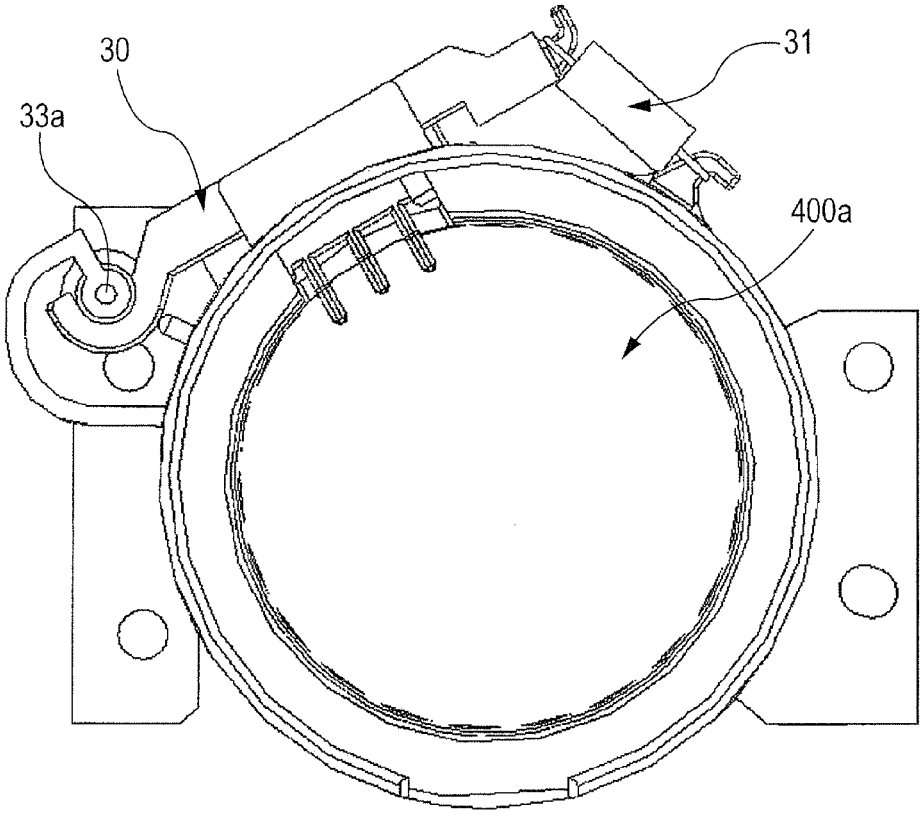
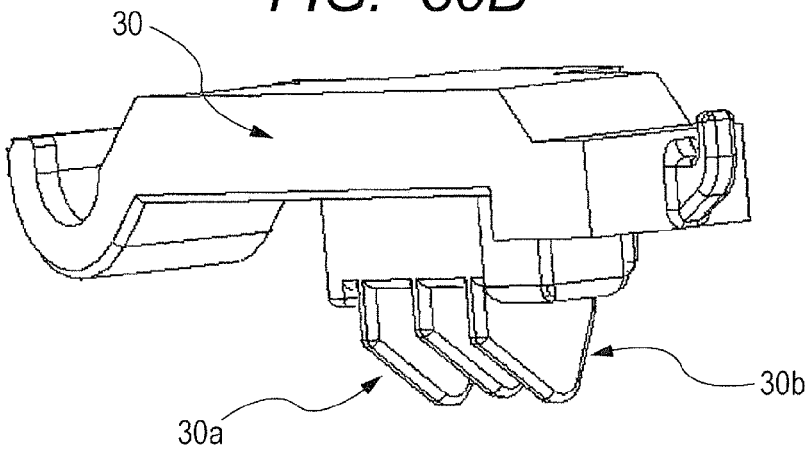


FIG. 30B



DEVELOPER REPLENISHMENT CONTAINER ACCOMMODATING APPARATUS, DEVELOPER REPLENISHMENT CONTAINER, AND IMAGE FORMING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a developer replenishment container accommodating apparatus, a developer replenishment container, and an image forming apparatus, and in particular, to a configuration for suppressing a vibration when replenishing a developer.

2. Description of the Related Art

In a conventional electrophotographic image forming apparatus such as a copy machine and a printer, a fine powder developer (toner) is used as a developer. When the developer of the electrophotographic image forming apparatus main body is consumed, the developer is replenished to the image forming apparatus main body by using a developer replenishment container (toner replenishment container). Because the developer is a considerably fine powder, when replenishing the developer, the developer replenishment container is kept in the image forming apparatus main body so that the developer is not scattered, and the developer is discharged through a small opening little by little (such a system is known as disclosed in Japanese Patent Application Laid-Open No. 2003-345112).

FIG. **27** is a perspective view of a developer replenishment container accommodating apparatus **400** provided in the image forming apparatus main body. The developer replenishment container accommodating apparatus (hereinafter referred to as an "accommodating apparatus") **400** includes a driving portion **22** that is coupled to a toner bottle as a developer replenishment container and drives the replenishment container to rotate. The driving portion **22** includes an open/close control member **21** that is driven to rotate by a driving motor portion **22***a* including a driving motor (not shown).

FIGS. **28**A, **28**B, **29**A, **29**B, **30**A, and **30**B are diagrams illustrating states of the accommodating apparatus **400** and a toner bottle **1** when the toner bottle **1** is put (accommodated) in the accommodating apparatus **400**. FIG. **28**A is a diagram illustrating a state in which an operation of putting the toner bottle **1** in the accommodating apparatus **400** is started. In this state, i.e., when the toner bottle **1** is in a position illustrated in FIG. **28**A, the toner bottle **1** is not secured to the accommodating apparatus **400**, and therefore, a user can mount the toner bottle **1** and remove the toner bottle **1** from the accommodating apparatus **400**.

A cylindrical discharging portion **1***e* for discharging a developer (not shown) is provided on one tip end surface of the toner bottle **1**, and an opening **1***a* of the discharging portion **1***e* is sealed by a sealing member **2**. A release protrusion **4** that is elastically bent is provided on a proximal portion of the sealing member **2**, and an engaging protrusion **3** that is elastically bent integrally with the release protrusion **4** is provided on a distal side of the sealing member **2**.

FIG. **28**B is a diagram illustrating a state in which the toner bottle **1** starts to be put in the accommodating apparatus **400** by a user pushing the toner bottle **1** in a direction indicated by the arrow "a". At this time, the sealing member **2** is inserted into the open/close control member **21** up to the release protrusion **4** provided on the proximal portion. At this time, the release protrusion **4** is pressed in an inner side direction by an inner circumferential surface of the open/close control member **21** and elastically bent in a direction indicated by the arrow "d", and at the same time, the engaging protrusion **3** is also bent toward the inner side. Therefore, the engaging protrusion **3** and the open/close control member **21** are in a state in which they are not engaged with each other. Further, when the sealing member is moved to this position, a positioning member **30** provided on the accommodating apparatus **400** side is engaged with a locking groove **1***d* formed in a side surface of a main body of the toner bottle **1**, and hence a container main body **1***c* of the toner bottle **1** is locked to the accommodating apparatus **400**.

When an operation of closing a replacement cover (not shown) is then started, along with a movement of the replacement cover, as illustrated in FIG. **29**A, the open/close control member **21** is retracted in the direction indicated by the arrow "a". With this operation, the release protrusion **4** of the sealing member **2** is recovered from a pressed state, and accordingly the engaging protrusion **3** is elastically locked (stopped) into a locking hole (not shown) provided in the open/close control member **21**. Further after that, when the replacement cover is closed, the open/close control member **21** is further retracted in the direction indicated by the arrow "a" keeping in a state of being engaged with the sealing member **2**. With this operation, as illustrated in FIG. **29**B, the sealing member **2** is separated from the toner bottle **1** so that the opening **1***a* is opened and the developer can be replenished.

When the driving motor portion **22***a* is driven in this state, the open/close control member **21** rotates, and the sealing member **2** engaged with the open/close control member **21** is rotated with the rotation of the open/close control member **21**. The rotation of the sealing member **2** is transferred to a rotation driving portion **1***b* so that the container main body **1***c* is rotated. That is, the sealing member **2** has a function of sealing the opening **1***a*, a function of receiving a rotational driving force from the accommodating apparatus **400**, and a function of transferring the rotational driving force to the toner bottle **1**.

By the rotation of the toner bottle **1** via the sealing member **2** in the above-mentioned manner, the developer contained in the toner bottle **1** is sequentially discharged through the opening **1***a* and received in a hopper **24** that is a temporary developer accommodating container. The hopper **24** includes an agitating member **25** and a screw member **26**, and the developer discharged from the toner bottle **1** is dropped to the hopper **24** by gravity and agitated by the agitating member **25**.

The agitating member **25** is rotated in a direction indicated by the arrow "c" by a driving mechanism (not shown) so that the developer is moved to the screw member **26** by gravity. The screw member **26** is configured to convey the developer by a driving mechanism (not shown) in an axial direction, i.e., from the back to the front in a direction orthogonal to the cross-sectional view of FIG. **29**B. Thus, when the screw member **26** is rotated, the developer is conveyed through a developer discharge port (not shown) of the hopper **24** to a developing device so that replenishment of the developer is performed.

When the replenishment of the developer is completed, the replacement cover is opened. When the replacement cover is opened, the open/close control member **21** moves from the position illustrated in FIG. **29**B in a direction indicated by the arrow "b" illustrated in FIG. **29**A. At this time, because the toner bottle **1** is locked to the accommodating apparatus **400** by the positioning member **30** with a predetermined biasing force, when the open/close control member **21** moves in this manner, the sealing member **2** is pushed into to seal the opening **1***a* of the toner bottle **1**. At the same time, the release protrusion **4** is pressed toward the inner side by the inner circumferential surface of the open/close control member **21**

and elastically deformed and bent in the direction indicated by the arrow "d". Accordingly, the engaging protrusion **3** is displaced toward the inner side so that the engagement of the engaging protrusion **3** and the open/close control member **21** is released, resulting in a state illustrated in FIG. **28**B.

As a result, in this state, the toner bottle **1** can be pulled out of the accommodating apparatus **400**, and the toner bottle **1** can be pulled out when the user pulls the toner bottle **1** with a force stronger than a maintaining force of a biasing member **31** described later, which is illustrated in FIG. **30**A, for biasing the positioning member **30**. That is, the putting of the toner bottle **1** in a replenishable position, the release of the toner bottle **1**, and the removal of the bottle can be performed by a reciprocating operation of the toner bottle **1** and the open/close control member **21** in the directions indicated by the arrows "a" and "b" that are the rotational axis direction of the toner bottle and a combination thereof.

By the way, the positioning member **30** is protruded in a retractable manner to an insertion portion **400***a* into which an end portion of the toner bottle **1** is inserted, as illustrated in FIG. **30**A. As illustrated in FIG. **30**B, the positioning member **30** includes a first tapered portion **30***a* that is inclined downward along a push-in direction and a second tapered portion **30***b* that is located on a downstream side of the first tapered portion **30***a* in the push-in direction and inclined upward along the push-in direction. Further, the positioning member **30** is biased in a direction of protruding into the insertion portion **400***a* by the biasing member **31** illustrated in FIG. **30**A.

When putting the toner bottle **1** in the accommodating apparatus **400**, a locking piece **1***g* that is vertically formed on the discharging portion **1***e* as illustrated in FIG. **28**A and forms a side wall surface of the locking groove **1***d* on the downstream side in the push-in direction first abuts on the first tapered portion **30***a* of the positioning member **30**. After that, when the toner bottle **1** is further pushed in, the locking piece **1***g* passes the positioning member **30** along the first tapered portion **30***a* while causing the positioning member **30** to be retracted from the insertion portion **400***a* against the biasing force of the biasing member **31**. When the locking piece **1***g* passes the first tapered portion **30***a* and moves along the second tapered portion **30***b*, the positioning member **30** is fitted into the locking groove **1***d* by the biasing force of the biasing member **31**.

In this manner, when putting the toner bottle **1** in the accommodating apparatus **400**, the positioning member **30** is pressed by the locking piece **1***g* so as to be retracted from the insertion portion **400***a*, and then when the locking piece **1***g* has passed the positioning member **30**, the positioning member **30** is protruded to the insertion portion **400***a* to be fitted into the locking groove **1***d*, as illustrated in FIG. **28**B. With this configuration, when the user pushes the toner bottle **1** into the accommodating apparatus **400**, a tension applied by the biasing member **31** is exerted on the user.

However, in the case of using the conventional accommodating apparatus and the toner bottle having the above-mentioned configuration, when fixing the position of the toner bottle **1** with respect to the accommodating apparatus **400**, looseness may occur between the locking groove **1***d* and the positioning member **30**. If such looseness occurs, when the toner bottle **1** is rotated to replenish the developer, the toner bottle **1** is rotated while causing a vibration due to the looseness.

When the toner bottle **1** is vibrated in this manner, the vibration may be transferred to an image forming portion, possibly generating an uneven image.

SUMMARY OF THE INVENTION

In view of the above-mentioned circumstances, the present invention provides a developer replenishment container accommodating apparatus, a developer replenishment container, and an image forming apparatus, which suppress a vibration at the time of replenishing a developer.

According to an exemplary embodiment of the present invention, there is provided a developer replenishment container accommodating apparatus in which a developer replenishment container is removably put in a main body of the accommodating apparatus, which replenishes a developer while rotating the developer replenishment container, the accommodating apparatus including: a holding portion provided on the main body of the accommodating apparatus and configured to hold the developer replenishment container put in the main body of the accommodating apparatus in a replenishment position for replenishing the developer; and a pressing portion configure to press the developer replenishment container put in the main body of the accommodating apparatus toward an upstream side in a push-in direction in which the developer replenishment container is pushed in the main body of the accommodating apparatus, wherein, when the developer replenishment container is put in the main body of the accommodating apparatus, the developer replenishment container is secured while being biased and pressed against the holding portion by the pressing portion.

Further, according to an exemplary embodiment of the present invention, there is provided a developer replenishment container which is removably put in a main body of a developer replenishment container accommodating apparatus and replenishes a developer while being rotated by the accommodating apparatus, the developer replenishment container including: a portion to be engaged which is disengageably engaged with a holding portion provided on the main body of the accommodating apparatus so that the developer replenishment container is held in a replenishment position for replenishing the developer when the developer replenishment container is put in the main body of the accommodating apparatus; and a portion to be pressed which is pressed by a pressing portion provided on the main body of the accommodating apparatus, wherein, when the developer replenishment container is put in the main body of the accommodating apparatus and is being rotated, the developer replenishment container is secured in a manner that the portion to be engaged is pressed against the holding portion by the portion to be pressed being pressed by the pressing portion.

According to the present invention, when the developer replenishment container is put in the main body of the accommodating apparatus, the developer replenishment container is secured while being biased and pressed against the holding portion by the pressing portion. Therefore, the vibration at the time of replenishing the developer can be suppressed, and occurrence of an uneven image can be reduced.

Further features of the present invention will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram illustrating a configuration of an image forming apparatus including a developer replenishment container accommodating apparatus according to a first embodiment of the present invention.

FIG. **2** is a perspective view of the developer replenishment container accommodating apparatus mounted in a main body of the image forming apparatus.

FIG. **3** is a perspective view of a toner bottle to be put in the developer replenishment container accommodating apparatus.

FIG. **4** is a diagram illustrating a state in which the toner bottle is put in the developer replenishment container accommodating apparatus.

FIGS. **5**A, **5**B, and **5**C are diagrams illustrating operations of a pressing portion and a locking mechanism when the toner bottle is put in the developer replenishment container accommodating apparatus.

FIG. **6** is a diagram illustrating a configuration of a locking mechanism provided in a developer replenishment container accommodating apparatus according to a second embodiment of the present invention.

FIG. **7** is a diagram illustrating configurations of a lock member and a click member constituting the locking mechanism illustrated in FIG. **6**.

FIGS. **8**A and **8**B are diagrams illustrating an operation of the click member.

FIGS. **9**A, **9**B, and **9**C are diagrams illustrating an operation of the locking mechanism when removing a toner bottle.

FIG. **10** is a graph showing a relationship between an operational force required for a user to remove the toner bottle and a movement distance of the toner bottle.

FIG. **11** is a diagram illustrating a positional relationship between the locking mechanism and a lever.

FIG. **12** is a diagram illustrating an open/close control member moving mechanism provided in the developer replenishment container accommodating apparatus according to the first and second embodiments.

FIGS. **13**A and **13**B are first diagrams illustrating a configuration of the open/close control member moving mechanism.

FIG. **14** is a second diagram illustrating the configuration of the open/close control member moving mechanism.

FIGS. **15**A and **15**B are first diagrams illustrating an operation of the open/close control member moving mechanism when removing a set toner bottle from the developer replenishment container accommodating apparatus.

FIGS. **16**A and **16**B are second diagrams illustrating the operation of the open/close control member moving mechanism when removing the set toner bottle from the developer replenishment container accommodating apparatus.

FIGS. **17**A and **17**B are third diagrams illustrating the operation of the open/close control member moving mechanism when removing the set toner bottle from the developer replenishment container accommodating apparatus.

FIG. **18** is a diagram illustrating a first other configuration of the open/close control member moving mechanism.

FIG. **19** is a diagram illustrating an operation of the open/close control member moving mechanism according to the first other configuration when removing a set toner bottle from the developer replenishment container accommodating apparatus.

FIG. **20** is a diagram illustrating an operation of the open/close control member moving mechanism according to a second other configuration when removing a set toner bottle from the developer replenishment container accommodating apparatus.

FIG. **21** is a diagram illustrating the second other configuration of the open/close control member moving mechanism.

FIG. **22** is a diagram illustrating a state in which both a replacement cover and an inner door of the open/close control member moving mechanism are closed.

FIGS. **23**A and **23**B are diagrams illustrating configurations of the replacement cover and the inner door.

FIGS. **24**A, **24**B, and **24**C are diagrams illustrating a state in which the replacement cover and the inner door are opened.

FIG. **25** is a graph showing a relationship between opening and closing angles of the replacement cover and the inner door.

FIGS. **26**A and **26**B are diagrams illustrating an operation when closing the replacement cover.

FIG. **27** is a perspective view of a conventional developer replenishment container accommodating apparatus.

FIGS. **28**A and **28**B are first diagrams illustrating a state of the developer replenishment container accommodating apparatus and a developer replenishment container when the developer replenishment container is put in the developer replenishment container accommodating apparatus.

FIGS. **29**A and **29**B are second diagrams illustrating the state of the developer replenishment container accommodating apparatus and the developer replenishment container when the developer replenishment container is put in the developer replenishment container accommodating apparatus.

FIGS. **30**A and **30**B are diagrams illustrating a positioning member provided in the developer replenishment container accommodating apparatus.

DESCRIPTION OF THE EMBODIMENTS

Exemplary embodiments of the present invention will be described in detail below with reference to the accompanying drawings. FIG. **1** is a diagram illustrating a configuration of an image forming apparatus including a developer replenishment container accommodating apparatus according to a first embodiment of the present invention. As illustrated in FIG. **1**, an image forming apparatus **900** includes a main body of an image forming apparatus (hereinafter referred to as an image forming apparatus main body) **900**A. An image forming portion **902** which forms an image on a sheet and an elevated operation portion **50** are provided on the image forming apparatus main body **900**A. An original feeding device **950** which feeds an original to a platen glass (not shown) is provided on an upper surface of the image forming apparatus main body **900**A. The image forming portion **902** includes a cylindrical photosensitive drum **906**, a charging device **907**, and a developing device (developing portion) **909**. A fixing device **912** and a pair of discharging rollers **914** are disposed on a downstream side of the image forming portion **902**.

An image forming operation of the image forming apparatus **900** having the above-mentioned configuration will be described. When an image forming signal is output from a CPU circuit portion (not shown), first, an original is placed on the platen glass by the original feeding device **950**. Then, an image of the original is read by an image reader (not shown), and digital data of the read image is input to an exposing unit (not shown). The exposing unit then irradiates the photosensitive drum **906** with light modulated in accordance with the digital data. At this time, because a surface of the photosensitive drum **906** is uniformly charged by the charging device **907**, when the surface of the photosensitive drum **906** is thus irradiated with the light, an electrostatic latent image is formed on the surface of the photosensitive drum **906**. When the electrostatic latent image is developed by the developing device **909**, a toner image is formed on the surface of the photosensitive drum **906**.

On the other hand, when a paper feeding signal is output from the CPU circuit portion, first, a sheet S that is set in cassettes **902***a* to **902***d* or a paper feeding deck **902***e* is conveyed to registration rollers **910**. The sheet S is then conveyed by the registration rollers **910** to a transfer portion including

a transfer charging device **905** at a timing to match a leading edge of the sheet S and a leading edge of the toner image on the photosensitive drum **906**. A transfer bias is applied to the sheet S by the transfer charging device **905** in the transfer portion so that the toner image on the photosensitive drum **906** is transferred to the sheet S. The sheet S to which the toner image is transferred is then conveyed to the fixing device **912** by a conveying belt **911**, and the toner image is thermally fixed to the sheet S while passing through the fixing device **912**. The sheet S to which the toner image is thermally fixed by the fixing device **912** is then discharged to a discharge tray **915** by the pair of discharging rollers **914**.

In FIG. **1**, a toner bottle **1** that is a developer replenishment container is removably mounted to the image forming apparatus main body **900**A in a horizontal direction. The developer discharged from the toner bottle **1** is temporarily accommodated in a hopper **24** that is a temporary developer accommodating container as an accommodating unit, and then sent to the developing device **909**. The toner bottle **1** is disposed above the image forming portion **902** so that the toner bottle **1** is not overlapped with the image forming portion **902**.

When replenishing the developer, the toner bottle is configured to be removably put (accommodated) in a developer replenishment container accommodating apparatus (hereinafter referred to as an "accommodating apparatus") illustrated in FIG. **2** that is mounted to the image forming apparatus main body **900**A. The accommodating apparatus **20** includes a main body of the developer replenishment container accommodating apparatus (hereinafter referred to as an "apparatus main body") **23** in which the toner bottle **1** is put, and a driving portion **22** configured to rotationally drive the toner bottle **1** put in the apparatus main body **23**. The accommodating apparatus **20** further includes the hopper **24** that is a temporary developer accommodating container for temporarily accommodating the developer discharged from the toner bottle **1**, and is located between the apparatus main body **23** and the driving portion **22**.

The driving portion **22** includes an open/close control member **21** that is movable along a push-in direction in which the toner bottle **1** is pushed in the apparatus main body **23** and is rotatable so as to rotate the toner bottle **1**, a driving motor portion **22***a* configured to rotate the open/close control member **21** by a driving motor (not shown), and a power transmission portion **22***b*. When the open/close control member **21** moves to a downstream side in the push-in direction, the driving motor portion **22***a* and the power transmission portion **22***b* are coupled to each other, and after that, when the driving motor portion **22***a* starts the driving, the open/close control member **21** is rotated via the power transmission portion **22***b*.

The hopper **24** includes a hopper main body **24***a*, an agitating member **25** that is disposed in a lower portion of the hopper main body **24***a* and agitates the replenished developer, and a screw member **26** configured to convey the developer to a developer container **11** of the developing device **909** illustrated in FIG. **1**.

The apparatus main body **23** includes a support portion **23***a* configured to support the toner bottle **1**. A lever **27** which is an engaging piece configured to engage with the toner bottle **1** when the toner bottle **1** is put in the apparatus main body **23** is provided under the support portion **23***a* so as to be slidable along the push-in direction. An engaging portion **27***a* protruding from the support portion **23***a* is provided on an end portion of the lever **27** on the downstream side in the push-in direction. A tip of the engaging portion **27***a* is formed in a rounded shape. A hook **27***b* is provided on an end portion of the lever **27** on an upstream side in the push-in direction. One end of a tension spring **28** is hooked on a hook **23***b* provided on a bottom surface of the support portion **23***a*, and the other end thereof is hooked on the hook **27***b*. The lever **27** is normally biased to the upstream side in the push-in direction by the tension spring **28** that is a biasing member.

As illustrated in FIG. **3**, the toner bottle **1** includes a container main body **1***c* configured to contain the developer, and a cylindrical discharging portion **1***e* provided on an end portion of the container main body **1***c* on the downstream side in the push-in direction. The discharging portion **1***e* is configured to discharge the developer contained in the container main body **1***c*. An opening **1***a* configured to discharge the developer is formed in a distal end of the discharging portion **1***e*. When the toner bottle **1** is unused, the opening **1***a* of the discharging portion **1***e* is sealed by a sealing member **2** which is inserted into the discharging portion **1***e* so as to be pullout from the discharging portion. A spiral groove **1***f* is formed in the container main body **1***c* of the toner bottle **1**. With the groove **1***f*, when the container main body **1***c* is rotated about the discharging portion **1***e* which constitutes an axis portion, the developer contained in the container main body **1***c* can be sent to the opening **1***a*. The discharging portion **1***e* which constitutes the axis portion is centered on a rotation axis A as described below and illustrated in FIG. **4**.

The discharging portion **1***e* has a diameter smaller than a diameter of the container main body **1***c*. An end surface of the container main body **1***c* which has a diameter larger than the diameter of the discharging portion **1***e* forms a biasing force receiving portion **37**. As described later, when the toner bottle **1** is put in the accommodating apparatus **20**, the engaging portion **27***a* of the lever **27** is engaged with the biasing force receiving portion **37** which is a portion to be pressed. In addition, a locking groove **1***d* into which a click portion **35***c* of a locking member **35** described later is locked when the toner bottle **1** is put in the accommodating apparatus **20** is formed between the biasing force receiving portion **37** and the opening **1***a*. A flange portion **38** which is disengageably engaged with the click portion **35***c* is provided between the biasing force receiving portion **37** and the opening **1***a*.

In FIG. **2**, a circular opening **24***b* is formed in the hopper main body **24***a*. The circular opening **24***b* has an inner diameter larger than the outer diameter of the discharging portion **1***e* of the toner bottle **1** illustrated in FIG. **3**. When the toner bottle **1** is put in the accommodating apparatus **20**, the discharging portion **1***e* is inserted into the hopper **24** through the opening **24***b*. When the discharging portion **1***e* is inserted in this manner, the sealing member **2** which seals the opening **1***a* is engaged with the open/close control member **21** while being fitted into the open/close control member **21** which is located on the opposite side of the opening **24***b* of the hopper main body **24***a*.

Further after that, when a replacement cover (not shown) is closed, the open/close control member **21** moves to the downstream side in the push-in direction while keeping a state of being engaged with the sealing member **2**. With this operation, as illustrated in FIG. **29**B described above, the sealing member **2** is separated from the discharging portion **1***e* so that the opening **1***a* is opened, and hence the developer replenishment can be performed. When the driving motor portion **22***a* is driven in this state, the open/close control member **21** is rotated. With the rotation of the open/close control member **21**, the sealing member **2** engaged with the open/close control member **21** is rotated.

The rotation of the sealing member **2** is transmitted to a rotation driving portion **1***b* which is provided in the container main body **1***c* and illustrated in FIG. **4** and FIGS. **9**A, **9**B and **9**C described later. When a rib **1***h* provided on an inner side of

the container main body **1***c* abuts on the rotation driving portion **1***b*, the container main body **1***c* is rotated about the rotation axis A. At this time, because the rib **1***h* is loosely fitted on the rotation axis A with respect to the rotation driving portion **1***b* (a position is not restricted on the rotation axis A with respect to the rotation driving portion **1***b*), the rib **1***h* and the rotation driving portion **1***b* do not contribute to suppression of looseness of the container main body **1***c* on the rotation axis A. The rotation axis A is a virtual axis extending in the push-in direction of the container main body **1***c*.

When the replenishment of the developer is completed, the replacement cover is opened. When the replacement cover is opened in this manner, the open/close control member **21** moves from the position illustrated in FIG. **29**B described above in the direction indicated by the arrow "b" illustrated in FIG. **29**A. With this operation, the engagement of the open/close control member **21** and the sealing member **2** is released as illustrated in FIG. **28**B, and the toner bottle **1** can be pulled out of the accommodating apparatus **20**.

Further, an elastic member **29** is provided on the upstream side of the hopper main body **24***a* in the push-in direction. The elastic member **29** comes into close contact with the downstream side portion of the toner bottle **1** in the push-in direction so as to prevent a scattering of the developer. The elastic member **29** is formed of a material such as PORON (trademark) into a cylindrical shape (disk shape). A magnetic sensor (not shown) is disposed on the outer side of the hopper **24**. The magnetic sensor responds when the developer supplied from the toner bottle **1** to the hopper main body **24***a* reaches a predetermined amount. Accordingly, the supply of the developer from the toner bottle **1** is stopped.

On the other hand, as illustrated in FIG. **4**, a lock mechanism **32** which is a holding portion configured to hold the accommodated toner bottle **1** in a replenishment position for supplying the developer is provided on the upstream side of the elastic member **29** in the push-in direction. The lock mechanism **32** includes, as illustrated in FIGS. **5**A, **5**B, and **5**C, a cylindrical support member **33** and the locking member **35** which is a pivot member provided so as to be pivotable about a pivot shaft **35***a* as a pivot point located above a straight line which passes through the center of the support member **33**. A hook **35***b* is provided on a rotating end of the locking member **35**. One end of a tension spring **36** is hooked on a hook **33***b* provided on the support member **33**. The other end of the tension spring **36** is hooked on the hook **35***b*. The locking member **35** is biased toward the support member **33** by the tension spring **36** which is a biasing member.

Further, on a bottom surface of the locking member **35**, the click portion **35***c* retractably protruding toward the inner side of the support member **33** through an opening **33***c* formed in the support member **33** is provided. As illustrated in FIG. **4**, the click portion **35***c* includes a first tapered portion **35***d* which is declined downward along the push-in direction and a second tapered portion **35***e* which is inclined upward along the push-in direction and located on the downstream side of the first tapered portion **35***d* in the push-in direction.

As illustrated in FIG. **4**, the lock mechanism **32** is disposed so that the lock mechanism **32** is located relatively above the lever **27** and the lever **27** is located on the upstream side in the push-in direction. In other words, a pressing portion **27**A including the lever **27** and the tension spring **28** and configured to press the toner bottle **1** toward the upstream side in the push-in direction is provided on the apparatus main body **23** in a region located on the upstream side of the lock mechanism **32** in the push-in direction and on a side opposite to the lock mechanism **32**.

Operations of the pressing portion **27**A and the lock mechanism **32** when the toner bottle **1** is put in the accommodating apparatus **20** configured in the above-mentioned manner will be described. FIG. **5**A illustrates a state in which the toner bottle **1** is being inserted into the hopper **24** of the accommodating apparatus **20**. At this time, the lever **27** is not in contact with the toner bottle **1**, and stands by on the most upstream side of a movable range by the tension spring **28**. Similarly, the locking member **35** is held in a position in which the click portion **35***c* is located in a position closest to the rotation center axis of the toner bottle **1** in a movable range of the locking member **35**.

After that, when the toner bottle **1** is inserted deep into the hopper **24** so that the biasing force receiving portion **37** of the toner bottle **1** reaches the standby position of the lever **27**, the engaging portion **27***a* of the lever **27** is brought into contact with the biasing force receiving portion **37**. With this operation, when the toner bottle **1** is kept on being inserted, as illustrated in FIG. **5**B, the lever **27** starts to move in a direction indicated by the arrow "e" against a tensile force of the tension spring **28**.

When the toner bottle **1** is further inserted, the flange portion **38** of the toner bottle **1** is brought into contact with the first tapered portion **35***d* of the click portion **35***c* of the locking member **35**. When the toner bottle is inserted in this state, the first tapered portion **35***d* receives a force from the flange portion **38**, and the click portion **35***c* is caused to move in a direction (upward direction) orthogonal to the push-in direction of the toner bottle **1**. When this force is stronger than the tensile force of the tension spring **36**, the locking member **35** moves in a direction away from the flange portion **38**, that is, a direction indicated by the arrow "m". The flange portion eventually presses the locking member **35** completely upward, and moves deeper (in the direction indicated by the arrow "e").

After that, the flange portion **38** moves along the second tapered portion **35***e* of the click portion **35***c*, and with this operation, the locking member **35** moves in the downward direction by the tension spring **36**. That is, when the flange portion **38** passes over the click portion **35***c*, as illustrated in FIG. **5**C, the locking member **35** returns to the original position by the tensile force of the tension spring **36**, and enters into the locking groove **1***d* of the toner bottle **1**, which is the portion to be engaged illustrated in FIG. **3**. When the click portion **35***c* enters into the locking groove **1***d* in this manner, the toner bottle is elastically held, by the click portion **35***c*, in the replenishment position for supplying the developer.

At this time, the lever **27** continues to constantly bias the biasing force receiving portion **37** of the toner bottle **1**. That is, in this embodiment, when the toner bottle **1** is put in the accommodating apparatus **20**, a lower portion of the toner bottle **1** which is below the rotation axis A of the toner bottle **1** on the downstream side in the push-in direction is biased by the lever **27**. In addition, an upper portion of the toner bottle **1** which is above the rotation axis A of the toner bottle **1** on the downstream side in the push-in direction is locked by the click portion **35***c* of the locking member **35** located on the downstream side of the lever **27** in the push-in direction.

In a state in which the upper portion is locked in this manner, when the biasing force is applied by the lever **27** to the lower portion on the upstream side of the click portion **35***c* of the locking member **35** in the push-in direction, a moment indicated by an arrow f illustrated in FIG. **5**C is exerted on the toner bottle **1**. With this moment, a side wall of the locking groove **1***d* of the toner bottle **1** on the opposite side of the flange portion **38** is pressed against the click portion **35***c* of the locking member **35**, and thus the toner bottle **1** is secured

to the accommodating apparatus **20**. As a result, even during the rotation by the operation of the driving portion **22**, the toner bottle **1** is rotated in a state in which the discharging portion **1***e* is slightly declined downward always without causing a vibration, thus enabling a continuous supply of the developer in a stable manner.

As described above, in this embodiment, when the toner bottle **1** is put in the apparatus main body **23**, the toner bottle **1** is secured while being biased and pressed against the lock mechanism **32** (the click portion **35***c* of the locking member **35**) by the engaging portion **27***a*. With this configuration, the looseness between the locking groove **1***d* and the click portion **35***c* of the locking member **35** can be eliminated, and therefore, the toner bottle **1** can be rotated without causing a vibration during the replenishment of the developer. As a result, the vibration at the time of replenishment of developer can be suppressed, and an adverse effect of the vibration on the image formation can be prevented. Accordingly, the image quality can be maintained.

Further, by biasing the toner bottle **1** to the upstream side in the push-in direction, i.e., in a pullout direction by the engaging portion **27***a*, when the toner bottle **1** is to be pulled out, the toner bottle **1** can be pulled out by a small force with the aid of the biasing force of the engaging portion **27***a*. Further, by declining the toner bottle **1** with the discharging portion **1***e* being lowered, the toner bottle **1** can be pulled out in an obliquely upward direction when pulling out the toner bottle **1**, which improves the operability.

In a case where the toner bottle **1** is not pushed in up to the position in which the toner bottle **1** is locked by the lock mechanism **32** when the toner bottle **1** is to be put in the accommodating apparatus **20**, the toner bottle **1** is pushed back by the biasing force (returning force) of the engaging portion **27***a*. Therefore, when the toner bottle **1** is to be put in the accommodating apparatus **20**, the user needs to push in the toner bottle **1** against the biasing force of the engaging portion **27***a* up to the position in which the toner bottle **1** is locked by the lock mechanism **32**, and hence the toner bottle **1** can be accommodated surely in the accommodating apparatus **20**. In addition, because the toner can be discharged in a stable manner by suppressing the vibration of the toner bottle **1**, the accuracy of detecting the remaining amount of the developer by the magnetic sensor (not shown) described above is improved.

In this embodiment, the locking groove **1***d* and the biasing force receiving portion **37** are provided in the vicinity of the opening **1***a* of the toner bottle **1**, i.e., on the downstream side in the push-in direction. However, the arrangement of the locking groove **1***d* and the biasing force receiving portion **37** is not limited thereto. The locking groove **1***d* and the biasing force receiving portion **37** may be arranged, for example, on an upstream side or a center portion of the toner bottle **1**. Further, the open/close control member **21** is moved when sealing the opening **1***a* by the sealing member **2** in the above description, but the present invention is not limited thereto. For example, the operation of the open/close control member **21** may be stopped after releasing the engagement with the sealing member **2**, and the sealing of the opening **1***a* may be performed by moving the toner bottle **1** in the push-in direction.

A second embodiment of the present invention will be described below. FIG. **6** is a diagram illustrating a configuration of a lock mechanism provided in the accommodating apparatus **20** according to the second embodiment. In FIG. **6**, the same reference symbols as those in FIG. **2** described above indicate the same or equivalent portions.

In FIG. **6**, a locking member **34** is provided so as to be pivotable about a pivot shaft **34***a* as a pivot point located above a straight line which passes through the center of the support member **33**. A hook **34***b* is provided on a rotating end of the locking member **34** which is a pivot member. One end of the tension spring **36** is hooked on the hook **33***b* provided on the support member **33**, and the other end thereof is hooked on the hook **34***b*. The locking member **34** is biased toward the support member **33** by the tension spring **36**.

Further, on the locking member **34**, a click member retractably protruding toward the inner side of the support member **33** through an opening formed in the support member **33** is pivotably provided. In addition, as illustrated in FIG. **7**, the locking member **34** includes a pair of U-shaped support portions **34***d* configured to support the click member **39** so as to be pivotable and movable in the up and down direction. In FIG. **7**, one of the U-shaped support portions **34***d* is not illustrated. Shafts **39***a* protruding from both side ends of the click member **39** are assembled in the U-shaped support portions **34***d*. Accordingly, the click member **39** can move in the up and down direction and pivot about the shaft **39***a* as a pivot point.

After assembling the click member **39** in the locking member **34** in the above-mentioned manner, a compression spring **40** illustrated in FIGS. **8**A and **8**B is assembled between a protruded portion **34***c* provided on the locking member **34** and a biasing member receiving portion **39***c* provided on an upper portion of the click member **39**. With this configuration, the click member **39** is held in a state of being biased in a direction indicated by the arrow "g" illustrated in FIG. **8**A with respect to the locking member **34**.

In addition, as illustrated in FIG. **7**, a click portion **39***b* is formed on a lower portion of the click member **39**. On the click portion **39***b*, as illustrated in FIGS. **8**A and **8**B, a first tapered portion **39***d* which is declined downward along the push-in direction and a second tapered portion **39***e* which is located on the downstream side of the first tapered portion **39***d* in the push-in direction and inclined upward along the push-in direction are formed. In addition, a pivot restricting portion **39***f* is provided in the vicinity of a part of the shaft **39***a* on the side of the biasing member receiving portion **39***c*.

In a lock mechanism having the above-mentioned configuration, normally, the click member **39** is held in a position illustrated in FIG. **8**A by being biased by the compression spring **40** via the biasing member receiving portion **39***c*. On the other hand, for example, as illustrated in FIG. **8**B, when a force "h" is applied to the click portion **39***b* of the click member **39**, the click member is pivoted in a direction indicated by the arrow "i" about the shaft **39***a* against the biasing force of the compression spring **40**.

When the click member **39** is pivoted by the force "h" in the above-mentioned manner, the pivot restricting portion **39***f* eventually abuts on the locking member **34**. With this configuration, the click member **39** is pivoted by a predetermined amount and then stopped. In this embodiment, the pivot restricting portion **39***f* abuts on the locking member **34** when the click member **39** is tilted by 10 degrees, but the restriction angle is not limited thereto.

A series of operations of removing the toner bottle **1** when using the lock mechanism **32** having the above-mentioned configuration will be described below. FIG. **9**A illustrates a state in which the toner bottle **1** is put (accommodated) in the accommodating apparatus **20**. In this state, the toner bottle **1** is locked in a manner that the flange portion **38** is sandwiched by the click portion **39***b* of the click member **39** and the elastic member **29**.

When the toner bottle **1** is moved in the direction indicated by the arrow "b" as illustrated in FIG. **9**B in order to remove the toner bottle **1**, first, the flange portion **38** is brought into contact with the second tapered portion **39***e* of the click portion **39***b* of the click member **39**. In this state, when the user gradually increases the force in the direction indicated by the arrow "b", the flange portion **38** applies the force "h" to the second tapered portion **39***e* as illustrated in FIG. **8**B described above. With this operation, the click member **39** is pivoted upward about the shaft **39***a* against the biasing force of the compression spring **40**. After that, as illustrated in FIG. **9**B, the click member **39** pivoted in this manner is stopped when the pivot restricting portion **39***f* abuts on the locking member **34**. When the click member **39** is pivoted in this manner, the toner bottle **1** is slightly moved in the direction indicated by the arrow "b".

After that, when the user further pulls the toner bottle **1**, as illustrated in FIG. **9**C, while the click member maintains the state in which the pivot restricting portion **39***f* abuts on the locking member **34**, the flange portion **38** presses up the click member **39** in a direction indicated by the arrow "k" via the second tapered portion **39***e*. With this operation, the locking member **34** which has been located in the engaging position in which the click member **39** is engaged with the toner bottle **1** is pivoted about the pivot shaft **34***a* in the upward direction against the tensile force of the tension spring **36**, and moved to an engagement release position in which the engagement of the click member **39** with the toner bottle **1** is released. As a result, the lock by the lock mechanism **32** is released, and the toner bottle **1** can be removed from the accommodating apparatus **20**.

FIG. **10** is a graph showing a relationship between an operational force F required for the user to remove the toner bottle **1** and a movement distance L of the toner bottle **1**. In FIG. **10**, a curve representing the relationship between the operational force F and the movement distance L in the case of removing the toner bottle in the conventional lock mechanism illustrated in FIGS. **27** to **30**B described above is indicated by a broken line. A curve representing the relationship between the operational force F and the movement distance L in the case of removing the toner bottle in the lock mechanism **32** according to this embodiment is indicated by a solid line.

In the conventional configuration, after the flange portion **38** abuts on the second tapered portion **30***b*, the positioning member **30** is pivoted about a shaft **33***a*. Therefore, a large operational force is required against the biasing force of the biasing member **31** in a period in which the toner bottle **1** is slightly moved along the second tapered portion **30***b* until the positioning member **30** is pressed completely upward. As a result, as can be seen from the curve indicated by the broken line, the operational force F is applied at an angle close to the virtually right angle, and immediately after the flange portion **38** passes over the second tapered portion **30***b*, the operational force F is attenuated.

On the other hand, in this embodiment, when the flange portion **38** abuts on the second tapered portion **39***e*, first, the click member **39** is pivoted by a predetermined amount. With this operation, an operational force against the biasing force of the compression spring **40** which biases the click member **39** is required while the toner bottle **1** is moved by a distance corresponding to the pivotal movement of the click member **39**. After that, while the click member maintains the state in which the pivot restricting portion **39***f* abuts on the locking member **34**, the locking member **34** is pivoted about the pivot shaft **34***a* so as to release the flange portion **38**. Therefore, as can be seen from the curve indicated by the solid line, a slope of the curve representing the operational force F with respect to the movement distance becomes smaller than that of the conventional configuration, and immediately after the flange portion **38** eventually passes over the second tapered portion **39***e*, the operational force F is attenuated.

Further, in the conventional configuration, an abrupt operational force is required at the moment when the user applies a force to remove the toner bottle **1**. In this case, the user feels heavy because the movement amount of the toner bottle **1** is considerably small. In addition, the user may feel that the toner bottle cannot be pulled out or the toner bottle may be broken. However, in this embodiment, the distance L from the start of the movement to a point at which the operational force F reaches the peak is longer than that of the conventional configuration. That is, the movement amount of the toner bottle **1** with respect to the operational force F required at the moment when the user applies a force to remove the toner bottle **1** is larger compared to that of the conventional configuration. Therefore, even when the magnitude of the operational force F is the same as that of the conventional configuration, the toner bottle **1** can be removed without causing an uncomfortable feeling about the removing operation.

FIG. **11** is a diagram illustrating a distance X between the lever **27** and the click member **39** and a movable range Y of the lever **27** according to this embodiment. In this embodiment, the movable range (movement distance) Y is set longer than the distance X. With this configuration, when the toner bottle **1** cannot be securely accommodated in the accommodating apparatus **20**, the toner bottle **1** is returned by the lever **27** by an amount of the movable range Y, thus enabling the user to recognize that the toner bottle **1** is not accommodated.

As described above, in this embodiment, an operation feeling of the user when removing the toner bottle **1** is improved through the pivoting of the click member **39** before the flange portion **38** of the toner bottle presses up the click member **39**, as well as the same effect as in the first embodiment described above being brought out. As a result, when removing the toner bottle **1**, the fear or the discomfort of the user can be eliminated.

After the toner bottle **1** is put in the accommodating apparatus **20** as described above, the replacement cover is closed so that the open/close control member **21** in the state of being engaged with the sealing member **2** is moved to a position in which the sealing member **2** is opened. Thus, the sealing by the sealing member **2** is released and the opening **1***a* is unsealed. In addition, when replacing the toner bottle **1**, the replacement cover is opened so that the open/close control member **21** is moved in the opposite direction. Thus, the opening **1***a* is sealed by the sealing member **2**.

However, when opening the replacement cover, if the opening of the replacement cover is not sufficient, the opening **1***a* is not fully sealed by the sealing member **2**, and therefore, if the toner bottle **1** is pulled out in this state, the developer may be scattered. For this reason, in the accommodating apparatus **20** according to the above-mentioned first and second embodiments, an open/close control member moving mechanism configured to cause the sealing member **2** to seal the opening **1***a* surely when pulling out the toner bottle **1** is provided. The open/close control member moving mechanism will be described below.

FIG. **12** is a diagram illustrating the open/close control member moving mechanism. In FIG. **12**, an open/close control member moving mechanism **102** includes a replacement cover **103** which is opened and closed when replacing the toner bottle **1**, a sealing member opening/closing mechanism **115**, and a link member **121** and a coupling member **122** configured to couple the replacement cover **103** and the sealing member opening/closing mechanism **115**.

The link member **121** is coupled to the replacement cover **103**. The coupling member **122** which is coupled to the link member **121** is coupled to the sealing member opening/closing mechanism **115** at a rotary shaft **123**. When the opening and closing of the replacement cover **103** is operated, the sealing member opening/closing mechanism **115** is actuated by the link member **121** and the coupling member **122** in conjunction with the opening and closing operation, and thus the open/close control member **21** is moved.

As illustrated in FIGS. **13**A and **13**B, the replacement cover **103** is pivotable about a pivot shaft **120** as a pivot point in the up and down direction. A protruded portion **103***a* is provided on the replacement cover **103**. On the other hand, a pivot hole **121***a* is provided in the link member **121**. By inserting the protruded portion **103***a* into the pivot hole **121***a*, the replacement cover **103** is pivotable as described later so that the link member **121** is moved via the protruded portion **103***a*.

Further, an elongated hole **121***b* is provided on an end portion of the link member **121** on the downstream side in the push-in direction, and an engaging protrusion **121***c* is provided on an end of the link member **121** on the downstream side in the push-in direction. Further, as illustrated in FIG. **14**, a protruded portion **122***a* and an engaging protrusion **122***b* are provided on the coupling member **122**. The protruded portion **122***a* of the coupling member **122** is inserted into the elongated hole **121***b* of the link member **121**. In addition, the engaging protrusion **122***b* is configured to be engaged with the engaging protrusion **121***c* of the link member **121** when the link member **121** is moved. A rail member **125** is provided on the accommodating apparatus **20** so that the coupling member **122** is restricted to move only in a direction indicated by the arrow I.

An operation of the open/close control member moving mechanism **102** having the above-mentioned configuration when removing the set toner bottle **1** from the accommodating apparatus **20** will be described below. In order to remove the toner bottle **1**, first, the user pivots the replacement cover **103** about the pivot shaft **120** as a pivot point in a direction indicated by the arrow H as illustrated in FIGS. **13**A and **13**B. The link member **121** is then moved in a direction indicated by the arrow K as illustrated in FIG. **15**A in conjunction with the movement of the protruded portion **103***a* of the replacement cover **103** along with the pivotal movement of the replacement cover **103**.

With this operation, the engaging protrusion **121***c* of the link member **121** and the engaging protrusion **122***b* of the coupling member **122** which have been separated from each other are engaged with each other as illustrated in FIG. **15**B. As a result, the coupling member **122** is also moved integrally with the link member **121** in the direction indicated by the arrow K. By the movement of the coupling member **122** in the direction indicated by the arrow K, the sealing member opening/closing mechanism **115** which is coupled to the coupling member **122** at the rotary shaft **123** is moved, and the sealing of the toner bottle **1** by the sealing member **2** is performed.

Along with the opening of the replacement cover **103**, as illustrated in FIG. **13**B, the protruded portion **103***a* of the replacement cover **103** is also pivoted in the direction indicated by the arrow H. Therefore, an initial operating direction of the link member **121** which is moved along with the opening of the replacement cover **103** has a large movement component in the direction indicated by the arrow K illustrated in FIG. **15**A. However, a slight movement component in a direction indicated by the arrow J is generated with the protruded portion **122***a* as a fulcrum. When the link member **121** is further moved in the direction indicated by the arrow K, the movement component in the direction indicated by the arrow J at a portion of the link member **121** on the downstream side in the push-in direction is increased.

When the movement component in the direction indicated by the arrow J at the portion of the link member **121** on the downstream side in the push-in direction is increased in the above-mentioned manner, the engaging protrusion **121***c* of the link member **121** is lifted in the direction indicated by the arrow J, and accordingly an engaging amount of the engaging protrusion **122***b* of the coupling member **122** with the engaging protrusion **121***c* of the link member **121** is decreased as illustrated in FIG. **16**A. Even though the engaging amount is gradually decreased in this manner, the link member **121** moves the coupling member **122** in the direction indicated by the arrow K up to the position in which the sealing member **2** completely seals the opening **1***a* of the toner bottle **1**.

When the sealing operation is completed, the engaging amount becomes zero, and the engaging protrusion **121***c* is separated from the engaging protrusion **122***b* as illustrated in FIG. **16**B. That is, the movement component of the engaging protrusion **121***c* of the link member **121** in the direction indicated by the arrow J becomes larger between the start of sealing of the toner bottle **1** by the sealing member opening/closing mechanism **115** and the end of sealing. When the sealing operation is completed, the engaging protrusion **121***c* is separated from the engaging protrusion **122***b*. Until the sealing operation is completed in this manner, the replacement cover **103** is in the position as illustrated in FIG. **17**A before the replacement cover **103** is fully opened. Therefore, the toner bottle **1** cannot be pulled out. With this operation, the scattering of the toner due to the user's pulling out the toner bottle before the toner bottle **1** is sealed can be prevented without fail.

After that, as illustrated in FIG. **16**B, the engagement of the engaging protrusion **121***c* and the engaging protrusion **122***b* is released so that only the link member **121** is moved. With this operation, as illustrated in FIG. **17**B, the protruded portion **122***a* of the coupling member **122** which is connected in the elongated hole **121***b* of the link member **121** eventually abuts on the left end portion of the elongated hole **121***b*. As a result, the movement of the link member **121** is stopped. At this time, the replacement cover **103** which is associated with the link member **121** is fully opened. In this state, the user can pull out the toner bottle **1** in the direction indicated by the arrow E.

In this manner, until the sealing member **2** reaches the position in which the opening **1***a* of the toner bottle **1** is completely sealed, the replacement cover **103** is not fully opened so that the scattering of the toner due to the user's pulling out the toner bottle **1** before the toner bottle **1** is sealed can be prevented without fail.

The configuration of the open/close control member moving mechanism **102** is not limited to the above-mentioned configuration. A first other configuration of the open/close control member moving mechanism **102** will be described below. FIG. **18** is a diagram illustrating the first other configuration of the open/close control member moving mechanism **102**. In FIG. **18**, the same reference symbols as those in FIGS. **13**A and **13**B described above indicate the same or equivalent portions.

As illustrated in FIG. **18**, a protruded portion **121***d* is provided on a lower portion of the engaging protrusion **121***c* of the link member **121**. A protruded portion **126** is provided on the accommodating apparatus **20**. When pulling out the toner bottle **1**, the replacement cover **103** is pivoted in the direction indicated by the arrow H as described above so that the link member **121** is moved in the direction indicated by the arrow

K illustrated in FIG. **18**. With the movement of the link member **121** in the direction indicated by the arrow K, the protruded portion **121***d* of the link member **121** is also moved in the direction indicated by the arrow K so that the protruded portion **121***d* interferes with the protruded portion **126**. With this configuration, as illustrated in FIG. **19**, the protruded portion **121***d* is pressed up in a direction indicated by the arrow L by the protruded portion **126** so that the engagement of the engaging protrusion **121***c* and the engaging protrusion **122***b* is released.

A position of the protruded portion **126** is adjusted so that the sealing of the toner bottle **1** is completed by the sealing member opening/closing mechanism **115** at the same time as the release of the engagement of the engaging protrusion **121***c* and the engaging protrusion **122***b*. At this time, the replacement cover **103** is in the position illustrated in FIG. **20**, and hence the toner bottle **1** cannot be pulled out yet so that the scattering of the toner due to the user's pulling out the toner bottle **1** before the toner bottle **1** is sealed can be prevented without fail. After that, when the engagement of the coupling member **122** and the link member **121** is released, the replacement cover **103** is opened up to the horizon as illustrated in FIG. **17**B, and the user can pull out the toner bottle **1** in the direction indicated by the arrow E.

A second other configuration of the open/close control member moving mechanism **102** will be described below. FIG. **21** is a diagram illustrating the second other configuration of the open/close control member moving mechanism **102**. In FIG. **21**, the same reference symbols as those in FIGS. **13**A and **13**B described above indicate the same or equivalent portions.

As illustrated in FIG. **21**, an inner door **127** is provided to be sandwiched by the toner bottle **1** and the replacement cover **103**. The inner door **127** is disposed in a position for blocking the pullout of the toner bottle **1** when the inner door **127** is closed. FIG. **22** is a diagram illustrating a state in which both the replacement cover **103** and the inner door **127** are closed.

The inner door **127** is pivotable about a pivot shaft **128** which is parallel to the pivot shaft **120** of the replacement cover **103**. The inner door **127** is pivotable in the direction indicated by the arrow H in the same manner as the replacement cover **103**. Further, the inner door **127** is always biased in the direction indicated by the arrow H by a spring (now shown). In addition, as illustrated in FIG. **23**A, the inner door **127** includes three (a plurality of) protruded portions **127***a*, **127***b*, and **127***c*, and as illustrated in FIG. **23**B, the replacement cover **103** includes three cams **103***b*, **103***c*, and **103***d*.

Shapes and operations of the protruded portions **127***a* to **127***c* provided on the inner door **127** and the cams **103***b* to **103***d* provided on the replacement cover **103** will be described below. Normally, the inner door **127** is always biased in the direction indicated by the arrow H illustrated in FIG. **22**, and therefore, the protruded portions **127***a* to **127***c* of the inner door **127** and the cams **103***b* to **103***d* of the replacement cover **103** always abut on each other, and the movement of the inner door **127** is controlled by the movement of the replacement cover **103**.

FIG. **24**A illustrates a state in which the replacement cover **103** is completely closed (a position of 90 degrees when the horizon is 0 degrees). At this time, the protruded portion **127***a* of the inner door **127** which is biased toward the replacement cover **103** by a spring (not shown) abuts on the cam **103***b* of the replacement cover **103**.

When the replacement cover **103** is completely closed, the replacement cover **103** is in the position of 90 degrees. In the position of 90 degrees, the replacement cover **103** is in a vertical state. When the replacement cover **103** is completely opened, the replacement cover **103** is in the position of 0 degrees. In the position of 0 degrees, the replacement cover **103** is in a horizontal state.

The cams **103***b* to **103***d* of the replacement cover **103** are formed so that only the replacement cover **103** is opened until the replacement cover **103** reaches a position of 30 degrees. Therefore, when the horizon is set to 0 degrees, until the replacement cover **103** is opened from the position of 90 degrees to the position of 30 degrees, as illustrated in FIG. **24**B, the inner door **127** maintains the state of being closed.

When the replacement cover **103** in this state is further opened in the direction indicated by the arrow H, the protruded portion **127***a* of the inner door **127** and the cam **103***b* of the replacement cover **103** are separated from each other, and instead, the protruded portion **127***b* and the cam **103***c* abut on each other. As a result, the inner door **127** starts to be opened in the direction indicated by the arrow H at an opening speed higher than that of the replacement cover **103**. FIG. **24**C illustrates a state in which the replacement cover **103** is completely opened. At this time, the inner door **127** is also opened up to the horizon (0 degrees) along with the replacement cover **103**. The portions abutting on each other at this time are the protruded portion **127***c* and the cam **103***d*. Therefore, the inner door **127** is supported by the replacement cover **103**, and is not opened any more.

FIG. **25** is a graph showing a relationship between opening and closing angles of the inner door **127** and the replacement cover **103**. As shown in FIG. **25**, the inner door **127** is not moved in a period in which the replacement cover **103** is opened from 90 degrees to 30 degrees. The inner door **127** is completely opened from 90 degrees to 0 degree in a period in which the replacement cover **103** is opened from 30 degrees to 0 degree. The toner bottle **1** is designed to be completely sealed when the replacement cover **103** is opened to 30 degrees.

In this manner, because the removal of the toner bottle **1** can be surely blocked by the inner door **127**, the toner bottle **1** is not pulled out in a period in which the replacement cover **103** is opened from 90 degrees to 30 degrees. In addition, because the toner bottle **1** is completely sealed in a period in which the replacement cover **103** is between 0 degree and 30 degrees, the developer is not scattered due to the user's pulling out the toner bottle **1** in the period in which the replacement cover **103** is between 0 degree and 30 degrees.

When performing an operation of closing the replacement cover **103**, the cam **103***d*, the cam **103***c*, and the cam **103***b* of the replacement cover **103** are sequentially brought into contact with the protruded portion **127***c*, the protruded portion **127***b*, and the protruded portion **127***a* of the inner door **127** in reverse order to the order at the time of opening the replacement cover **103**. With this operation, the inner door **127** is completely raised to 90 degrees in a period in which the replacement cover **103** is raised from the horizon to 30 degrees.

With this operation, even when the toner bottle **1** is put in the accommodating apparatus **20** and is in the position illustrated in FIG. **26**A in the state of not being set, a rear end portion of the toner bottle **1** is pushed in the direction indicated by the arrow A by the inner door **127**. As a result, the toner bottle **1** is surely set, achieving the state illustrated in FIG. **26**B.

In this manner, by providing the inner door **127**, the toner bottle **1** can be set simply by closing the replacement cover **103**, although an operation of closing the replacement cover **103** after setting the toner bottle **1** in a position in which the toner bottle **1** can be unsealed as illustrated in FIG. **26**B is required in the conventional configuration.

While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

This application claims the benefit of Japanese Patent Application No. 2011-276318, filed Dec. 16, 2011, which is hereby incorporated by reference herein in its entirety.

What is claimed is:

1. A developer replenishment container accommodating apparatus which receives a removable developer replenishment container and which replenishes a developer while rotating the developer replenishment container, the accommodating apparatus comprising:

a holding portion provided on a main body of the accommodating apparatus and configured to hold the developer replenishment container received in the main body in a replenishment position for replenishing the developer; and

a pressing portion configured to press the developer replenishment container disposed in the main body in a direction opposite to a push-in direction in which the developer replenishment container is received, the pressing portion being provided upstream of the holding portion in the push-in direction, and the pressing portion pressing the developer replenishment container against the holding portion while the developer replenishment container is rotated.

2. The developer replenishment container accommodating apparatus according to claim **1**, wherein the pressing portion is provided on a side opposite to the holding portion.

3. The developer replenishment container accommodating apparatus according to claim **1**, wherein the pressing portion comprises:

an engaging piece configured to engage with the developer replenishment container when the developer replenishment container is moved in the push-in direction; and

a biasing member configured to bias the engaging piece in the direction opposite to the push-in direction,

wherein the engaging piece engages with the developer replenishment container before the developer replenishment container is held by the holding portion, and is moved together with the developer replenishment container against a biasing force of the biasing member.

4. The developer replenishment container accommodating apparatus according to claim **1**, wherein

the holding portion comprises a click portion configured to engage with the developer replenishment container; a holding member configured to hold the click portion; a support portion configured to support the holding member movable between an engaging position in which the click portion engages with the developer replenishment container and an engagement release position in which an engagement of the click portion and the developer replenishment container is released; and a biasing member configured to bias the holding member to position the holding member in the engaging position.

5. The developer replenishment container accommodating apparatus according to claim **3**, wherein the holding portion comprises a click portion to engage with the developer replenishment container, and a movement distance of the engaging piece in the push-in direction is longer than a distance between the click portion and the engaging piece in the push-in direction.

6. The developer replenishment container accommodating apparatus according to claim **4**, wherein the holding member is supported by the support portion so as to be pivotable in a direction orthogonal to the push-in direction,

when the developer replenishment container is pulled out, the holding member is moved to the engagement release position after the click portion is pressed by the developer replenishment container so as to be pivoted by a predetermined amount.

7. The developer replenishment container accommodating apparatus according to claim **6**, wherein a biasing force of the biasing member of the holding portion is larger than a biasing force of the click portion.

8. An image forming apparatus, comprising:

a developing portion configured to develop an electrostatic latent image with a developer; and

per replenishment container accommodating apparatus according to claim **1**.

9. A developer replenishment container detachably mountable to a main body of a developer replenishment container accommodating apparatus to replenish a developer, the main body of the accommodating apparatus including a projecting portion configured to determine a position of the developer replenishment container to discharge the developer with respect to the main body and a biasing portion configured to bias the developer replenishment container in a direction opposite to an inserted direction in which the developer replenishment container is inserted into the main body, the developer replenishment container comprising:

a container body configured to contain the developer and rotatable about an axis thereof, the container body being provided with an opening at one axial end portion thereof, the opening being configured to permit discharge of the developer contained in the container body;

an open/close member configured to open and close the opening;

an inserted portion into which the projecting portion is inserted, the inserted portion including a first surface portion disposed upstream of the opening in the inserted direction and configured to be engageable with the projecting portion and a second surface portion disposed opposite to the first surface portion in the inserted direction at a position upstream of the first surface portion in the inserted direction and configured to be engageable with the projecting portion; and

a portion to be biased disposed upstream of the first surface portion in the inserted direction and configured to be biased in the direction opposite to the inserted direction by the biasing portion so that during rotation of the container body, the biasing portion causes the first surface portion to contact the projecting portion.

10. The developer replenishment container according to claim **9**, wherein the first surface portion has a shape protruding from a surface of the container body.

11. The developer replenishment container according to claim **9**, further comprising a sealing member provided at a side adjacent to the container body and configured to seal the opening when the sealing member and the container body are in a first position relative to one another, the opening becoming unsealed by a relative movement of the sealing member and the container body away from one another from the first position to a second position relative to one another.

12. The developer replenishment container according to claim **11**, further comprising a feeding portion configured to feed the developer in the container body toward the opening by rotating the container body.

13. The developer replenishment container according to claim **9**, wherein the portion to be biased is provided on a side opposite to the projecting portion.

14. The developer replenishment container according to claim **9**, wherein the first surface portion is provided at a downstream end of the developer replenishment container in the direction in which the developer replenishment container is inserted into the main body, and the portion to be biased is biased so that the container body is rotated with the opening being inclined downward and the first surface portion is pressed against the projecting portion.

15. The developer replenishment container according to claim **9**, wherein the portion to be biased is rotatable integrally with the first surface portion.

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